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ABSTRACT

This teacher's guide, one of nine teacher packages developed for use in the sequential, hands-on, field-oriented, K-8 environmental education program of the Martin County Schools in Florida, was developed for use with elementary children in grade five prior to and after a visit to an environmental studies center located near an estuarine area. The grade five program centers around the theme of "Ecosystems" and concludes the fact-finding segment of the program. The concepts of food and energy webs are used to illustrate the interaction of all organisms within the various communities of an estuarine ecosystem. This guide contains teacher instructions, scripts, tests with keys, and a copy of all student materials. Card games, slide/tape programs, and 8 mm film loops are not included. General and specific program objectives are stated and a program outline, including learning activities to be completed at the school and environmental studies center, is detailed. (BT)

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5th Grade

Ecosystems

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SE 022 820

Martin County Schools'
ENVIRONMENTAL STUDIES CENTER
2900 NE Indian River Drive, Jensen Beach, Florida 33457

TABLE OF CONTENTS AND CHECKLIST

This packet contains teacher instructions, scripts, test with answer key and a copy of all student materials.

We suggest you cover these materials in the order listed in this packet.

In parenthesis after each item is the quantity you will need for your class and whether it is expendable or to be returned.

* Also listed but not included in this booklet are items such as flash cards, slide/tapes, feltboard and pieces, etc.

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1. Program Summary
2. Teacher Instructions
3. Center Activities
4. Teacher Supplement, "Grassflat Habitat"
5. Teacher Supplement, "Mangrove Communities"
6. Script for slide program, "Vocabulary"
* 7. Slide/tape program, "Vocabulary"
8. Script for slide program, "Organisms of the Indian River Ecosystem"
9. Student script for "Orgamisms of the Indian River Ecosystem" - illustrated for student use (one for each student-to be returned)
*10. Slide/tape program, "Organisms of the Indian River Ecosystem"
11. Student booklet, "What is an Ecosystem?" (one for each student-to be returned)
12. Student booklet, "Food Webs" (one for each student-to be returned)
13. Instructions for card game "Eat and Be Eaten"
*14. Card game "Eat and Be Eaten" (student use-to be returned)
15. Student activities booklet (one for each student-expendable)
16. Data sheets (will be furnished at the Center visit)
17. Student test (one for each student-to be returned)
18. Test answer sheet with key (one set for each student-expendable)

FIFTH GRADE PROGRAM SUMMARY

GENERAL OBJECTIVE: To acquaint the student with the physical and biological interrelationships of a saltwater ecosystem and provide him evidence that he is an integral part of it resulting in his successful completion of the performance activities for the specific objectives.

SPECIFIC OBJECTIVES: The student will on the test:

1. demonstrate with 70% proficiency knowledge of ecosystem relationships in the Indian River when given questions pertaining to these relationships and a choice of possible answers;
2. demonstrate with 70% proficiency an understanding of energy flow within an ecosystem when given a question pertaining to food chain concepts and a choice of possible answers, when given an incomplete food chain with possible organisms to complete it and by constructing food webs when given a list of organisms;
3. demonstrate with 80% proficiency knowledge of selected vocabulary words when given a definition and choice of words, or when given a word and a choice of definitions;
4. identify with 80% proficiency organisms and characteristics of selected organisms found in the Indian River ecosystem when given pictorial representations of organisms and choice of names and/or a characteristic and choice of organisms.

PROGRAM OUTLINE:

A. Activities at home school (two to three weeks)

1. Slide/tape show - vocabulary associated with the Indian River ecosystem
2. Slide/tape show - organisms of the Indian River ecosystem
3. "Food Web" booklet
4. "Organism" booklet
5. Card game - to illustrate food web concepts
6. "What is an Ecosystem?" booklet
7. Activities booklet - crossword puzzles, pencil games, etc.
8. Demonstration of hydrometer kit
9. Three 8mm film loops about plankton, mangroves, food webs
10. (Visit to Center)
11. Follow-up discussion
12. Post-test

B. Activities at the Center - two day program (4-5 hours each day)

1. First day

a. Mangroves - students are taken to an area of mangroves where they collect data on the biological and physical factors of the area.
b. Plankton collection - students pull a plankton net through the water to collect microscopic organisms for later study at the Center.
c. Discussion groups - students discuss data collected in the field and explore ecological relationships found there.

d. Plankton observation - students use stereo microscopes to observe plankton collected in the field and discuss the importance of plankton in the food chain.

2. Second day

a. Grassflats - students seine in the river and collect typical river organisms. Recordings are made of numbers and types of organisms found. Measurements are also made of the physical and other biological factors of the area.
b. Discussion groups - the ecosystem concept is developed using data collected in both day's field experiences.
c. Food webs - students develop food webs using organisms found in both the mangrove and grassflat areas.
d. Museum and wet lab - students observe aquariums and tanks containing local saltwater specimens.

FIFTH GRADE TEACHER INSTRUCTIONS

INTRODUCTION: The Fifth Grade program ties together two saltwater communities, grassflats and mangroves, and develops the concept of ecosystems. Although it is not necessary for students to have gone through the Environmental Studies Center's Third and Fourth Grade programs, the Fifth Grade program lends itself well as an extension of those programs.

There are four units presented in booklet form, slide-tape or both. To accompany this material there are film loops and a "Student Activities Booklet" for the various units.

It is suggested that the units be presented in the order in which they appear in this teacher's booklet (vocabulary, organisms, Indian River ecosystem, and food webs).

During the 5th Grade program the students will be doing investigations of both the mangrove swamp and the grassflats of the Indian River Lagoon. Their activities will take them from the classroom into the lagoon itself and to the Environmental Center.

If we can be of assistance to you in the successful presentation of this material, do not hesitate to call us.

PROGRAM AND MATERIALS

If mangrove and grassflat communities are a new area to you, prepare first by reading the teacher supplements, "The Grassflat Habitat" and "Mangrove Communities". These will give you a background.

Vocabulary Unit - The vocabulary unit, along with a short introduction, is a slide/tape presentation.

To start the show, set up the projector and tape player. Project the first slide (FOCUS) and start the tape. There will be an audible "beep" to indicate a slide change.

All vocabulary words are given with the phonetic spelling and are listed in the "Student Activities Booklet". This may be of help in working this unit into a language arts project.

In the "Student Activities Booklet" there is a crossword puzzle and a word search to supplement the vocabulary unit.

Organisms of the Indian River Ecosystem - The materials covering this unit are a slide/tape show and an accompanying illustrated student script. Please encourage the students to follow along with their script and to make comparisons between actual photographs and the drawing of the various organisms. Often it is helpful to be able to recognize an animal from a drawing as well as from a photograph.

In the "Student Activities Booklet" there is a crossword puzzle and a word search using the names of the organisms of this unit.

The film loops "Collecting Plankton" and "Plankton Eaters" are appropriate for this unit. They both show some of various organisms studied. You may elect to show "Plankton Eaters" with the Food Web Unit.

The Ecosystem - "What Is An Ecosystem?" is the short booklet that makes up the ecosystem unit. It is to be read and discussed by the students. Hopefully it will recall some experiences that most students have had at the Environmental Center in the 3rd and 4th Grades. The booklet will also lead into the food web unit.

Food Web Unit - A food web concept, rather than the food chain, is introduced in this unit. Through the booklet "Food Webs" the student is exposed to the idea that more than one organism can eat another type of organism.

A card game to reinforce the food web concept has been included in the materials. Instructions for the game, "Eat and Be Eaten", are in the back of this booklet.

The film loop "Plankton Eaters" is a good example of the food web concept.

. . . .

This concludes the classroom Pre-Activities. You should now be fully prepared for a visit to the Environmental Studies Center. Please let us know which activities were/were not successful, and what activities of your own you may have added. After your visit to the Center we suggest at least one day of review before giving the test.

TEST

To post-test your student for your records, copies of the test and answers are included. The test is to be given after your students visit the Center. The test mean for 1974-75 Fifth Grade students completing a full program was 70.0.

Martin County Schools'
Environmental Studies Center
2900 N.E. Indian River Drive
Jensen Beach, Fla. 33457

FIFTH GRADE CENTER ACTIVITIES

TWO DAYS
4 TO 5 HOURS EACH DAY

FIRST DAY

I. INTRODUCTION

Students are given an introduction to the Environmental Studies Center and an overview of the activities in which they will be involved. Topics include:

1. Mangrove and grassflat communities
2. The Indian River ecosystem
3. Data sheets to be used in the field
4. How the equipment is used
5. Outlines of the various field and Center activities
6. Safety rules and regulations

II. MANGROVE STUDY

Students are divided into groups of four or five per group. Then they are taken to an area where red, black and white mangroves are found. They make observations on the succession of the mangroves and the location of each type of mangrove. These observations are recorded on their data sheets and kept for further discussion. They also note and collect organisms found on and around the different types of mangroves. The students bring back to the Center samples of leaves, detritus, etc. which are observed under stereoscopes and used in further discussion. Measurements are made and recorded of the general physical conditions of the area, such as: temperature of the water, air and soil; wind direction and speed; water turbidity and other pertinent physical factors. Each group also pulls a plankton net through the water to collect plankton for observation back at the Center.

III. CLEAN UP AND LUNCH

After returning to the Center students are asked to help clean up the field equipment. The students themselves are hosed down and given a chance to change into dry clothes.

Rooms are available in which students eat lunch; however, if the weather is nice why not have a picnic on the patio? Frisbees, checkers and hopscotch are available for after lunch activities.

IV. DISCUSSION

Students divide into original groups. They discuss information on their data sheets emphasizing the mangrove habitat. Topics include: types of mangrove and where found; the importance of mangroves as rookeries, soil builders and habitat; the role of mangrove detritus in the food chain; and effects of changes in the mangrove population.

V. PLANKTON AND DETRITUS STUDY

Students observe various forms of plankton and detritus collected in the field using stereo microscopes. Identification is made of as many forms of plankton as possible using field guides. A general discussion is held on the importance of plankton and detritus as a base of the food webs of the Indian River Ecosystem.

SECOND DAY

I. GRASSFLAT STUDY

The students are divided into their original groups from the first day's activities. Then they are taken to an area of the Indian River where grassflats are easily accessible.

Students are instructed how to seine. Basic safety rules and regulations are stressed. Each student who comes properly dressed makes at least one sweep in the grassflat. After each sweep they identify and count animals found and record this information on their data sheets.

II. CLEAN UP AND LUNCH

After returning to the Center students are asked to help clean up the nets and other pieces of equipment. The students themselves are hosed down and given a chance to change into dry clothing.

Again, rooms are available in which students may eat lunch, however if the weather is nice a picnic on the patio would be better.

III. DISCUSSION

Students divide into original groups. They discuss information on their data sheets emphasizing organisms found and physical factors of the grassflat. General topics include salinity, sunlight, temperature, weather conditions, season and ecological relationships.

IV. FOOD WEBS

Students spend time discussing the formation of a food web. They construct food webs using organisms found in both their mangrove and grassflat experiences.

V. ECOSYSTEM DYNAMICS

In this discussion period all concepts of the two days' activities are tied together. The general ecosystem concept is developed and applied to the Indian River. Topics such as succession, stress, interrelationships, and man's niche in the overall ecosystem are developed.

VI. MUSEUM AND WET LAB

Students tour the facilities of the Environmental Studies Center and observe aquariums and tanks containing live specimens of organisms commonly found in the Indian River Ecosystem. Displays, books and periodicals are also available for student use.

INDIAN RIVER LAGOON

The Grassflat Habitat

Habitat is defined as the place where a plant or animal lives. In your visit to the Environmental Studies Center, you and your students will be introduced to a specific kind of habitat - a salt water grassflat. You will see grassflats covering large areas of the Indian River lagoon.

For a grassflat to exist in the Indian River, certain conditions must be met. First, a substrate (soil) is necessary for the grass to attach its roots, for these plants are not free-floating or carried about by the tide as plankton is.

Second, you will notice that the grass grows in relatively shallow water. Sunlight must be able to penetrate to the grass if it is to supply sufficient energy for photosynthesis to take place. You will also notice that the grass is seldom completely exposed at low tide. Obviously the grass needs to be covered by water most of the time.

With these two factors - water deep enough to cover the plant, yet shallow enough to allow sunlight to penetrate - you can begin to see some of the physical limiting factors considered in an environmental study of a grassflat habitat.

Other important physical factors for this type of habitat would be: current, temperature range, pressure, salinity range, amount of oxygen, carbon dioxide and minerals present.

Living within this environment are plants and animals well adapted to it, displaying an interrelationship of animal dependence upon plant and plant dependence upon animal. You will note various types of algae on the grassflat, both microscopic and macroscopic. Most of those which are free floating are contingent upon the tides. Other algae may be trapped by or attached to the grass.

Microscopic examination of the water reveals tiny planktonic forms of plants and animals. The phytoplankton (plants), along with the grasses, is a primary energy source for other inhabitants of the grassflat. We often think of terrestrial plants as our major oxygen producers. In truth the phytoplankton of the world's water produce about 90% of our oxygen supply.

Zooplankton is made of of one-celled animals and both larval and adult forms of many multicellular animals. These are generally the first order consumers. They feed on the phytoplankton. The zooplankton are fed upon, in return, by larger animals, the second order consumers. This process continues with larger generally feeding on smaller until a continuous food chain is formed. Since the same organisms are common in many different food chains there is an intermeshing of food chains within a habitat forming a food web.

Associated with the salt water grassflat are long-legged wading birds (herons) which are predators. If you dig into the soil, you will find various forms of worms. Certain organisms such as crabs function as a sanitation department by consuming detritus and dead organisms. Parasites and saprophytes (including certain fungi and bacteria) play their role in helping recycle organic materials

through the system.

A typical sweep of a grassflat with a seine net turns up a variety of organisms. Some examples are game fish such as snook and trout. Others might be snapper, sheepshead and blow fish. Also plentiful in this habitat are several species of shrimp as well as crabs (spider, hermit and blue).

Other common animals found at various seasons are pipefish, horseshoe crabs, sea squirts and flounders. You will often see egg masses and egg cases attached to grass blades.

A plentiful food supply is not the only reason we find these grassflat inhabitants. Examination will show most of them are comparatively small. They can live in shallow water and find a safe hiding place in the grass.

We can liken the grassflat to a nursery. Removing any link in the food chain, or drastically altering the physical environment could disrupt the habitat. One obvious result would be the economic loss to the community of mature gamefish and crustaceans.

VOCABULARY

ALGAE - plants with chlorophyll, but lacking true roots, stems and leaves

BENTHIC ZONE - bottom zone of river or ocean

BRACKISH - water which has low salt content; water in which salinity ranges from approximately 0.5 to 17.0 parts per thousand

CARNIVORE - any organism that eats meat exclusively

COMMUNITY - a group of interdependent populations of organisms in a particular environment

CONSUMER - in a food chain, a plant or animal that must depend upon other plants and animals for its energy for living.

CRUSTACEA - a class of arthropods which breathe by means of gills, and the body is covered by a hard shell or crust; also have two pair of antenna; includes barnacles, shrimp and crabs.

DETRITUS - bits of food; dead leaves, twigs, algae, etc.; remains of animals.

ECOSYSTEM - the interaction in time and space of the biological community and the physical environment.

ENVIRONMENT - all the factors that affect an organism or group of organisms

ESTUARY - a partially enclosed section of a coastal body of water where a river meets ocean tides, producing a mixture of salt and fresh water.

FOOD CHAIN - sequence of organisms starting with the green plant, in which each is food for a higher or more complex organism

FOOD WEB - the many connected food chains by which organisms of a community obtain their energy

GRASSFLAT - a salt water habitat characterized by marine grass in shallow water

HABITAT - the place where an organism lives

LAGOON - an area of salt or brackish water separated from the sea by low sand-banks.

LARVA - early form of any animal that at birth is unlike its parents and must pass through one or more metamorphoses (changes) before assuming the adult characteristics

LIMITING FACTOR - any factor that tends to slow down growth in an ecosystem; a regulatory factor.

Vocabulary - Page 2

MACROSCOPIC - easily seen by the unaided eye

MICROSCOPIC - too small to be seen without the use of mangification

MOLLUSCA - a phylum of invertebrates with soft, unsegmented bodies covered by a fleshy mantle which usually secretes a shell; chiton, snail, oyster, squid

NICHE - the interaction of a specific organism with its environment

NURSERY - a habitat,usually protected, where larval stages of marine organisms live

ORGANISM - any living thing

PARASITE - an organism that lives in or on another organism from whose body it takes nutrients, thus harming it to some extent

POPULATION - groups of individuals of any one kind or organism in a community

PELAGIC ZONE - ocean water zone beyond the continental shelf

PHOTOSYNTHESIS - the process by which plants with chlorophyll use light energy to manufacture carbohydrates and release oxygen

PHYTOPLANKTON - the plants occuring in plankton; diatoms and dinoflagellates

PLANKTON - usually small plants and animals in water that drift with the currents

SALINITY - a measure of the quantity of dissolved salts in sea water, usually expressed in parts per thousand.

SAPROPHYTES - an organism that secures its nutrients from dead or decaying matter

SESSILE - attached; not free swimming; e.g. barnacles, oysters, sea squirt, etc.

SYMBIOSIS - association between unlike living plants and animals in which one or both are benefited and neither is harmed.

TERRESTRIAL - land, as opposed to water or air

ZOOPLANKTON - animal forms of plankton, including copepods, protozoans, eggs, larvae

MANGROVE COMMUNITIES

The word mangrove may be used to describe an individual plant species or an association of plants found in the marine intertidal environment. The word mangrove is a combination of the Portuguese "mangue" and the English "grove". If used to describe an individual plant species the word is usually prefaced by a descriptive adjective such as red mangrove or black mangrove. When used to describe an association of plants it generally refers to a group of flowering, seed-bearing trees growing in or closely associated with the marine intertidal zone. This association is sometimes called a tidal woodland.

Mangroves are found mostly in the tropics; although some are found in temperate zones where favorable currents and temperatures exist. Characteristically, mangroves grow in quiet lagoons or estuaries. Since mangroves grow only in the intertidal zone or in close association with the intertidal zone, the tidal range influences the amount of mangrove vegetation. Where the tidal range is wide mangroves form broad zones of swamp-like vegetation but are restricted where the tidal range is reduced. Because of this association with the tides, mangroves may be used as an indication of the high water line along the shore of an estuary or lagoon.

In Florida two distinct types of communities are found in the intertidal zone of the estuaries and lagoons. In northern Florida the intertidal zone is characterized by the salt marsh community composed of Spartina or cordgrass and Juncus or black rush. South of Cedar Key on the west coast and Daytona Beach on the east coast the salt marsh gives way to the mangrove swamp. In Martin County most of the natural shoreline of the Indian River lagoon is covered by mangrove thickets. In the intertidal zone of some of the spoil islands in the Indian River lagoon cordgrass may still be found, but it is slowly being replaced by young mangroves.

Although over thirty species of plants may be classified as mangrove, only three types of mangroves are commonly found in the south Florida area: the red mangrove (Rhizophora mangle) characterized by long prop roots which extend from the branches of the tree down into the water; the black mangrove (Avicennia germinans) characterized by a darker bark and pneumatophores (finger-like roots) which stick up out of the soil around the base of the tree; and the white mangrove (Laguncularia racemosa) characterized by shorter pneumatophores than the black mangrove and oval leaves with notches in the tips of the leaves. These trees are commonly found in a succession with the red mangrove growing in the lower tidal areas, black mangrove growing in the higher tidal areas, and the white mangrove growing landward from the red and black.

The role of the mangrove in the estuarine or lagoon ecosystem is varied and extensive. The mangrove serves as the dominant primary producer, land builder and water retainer, and home for many plants and animals.

As a primary producer the mangrove serves as the base of the food chain for many of the animals found in the Indian River lagoon. By process of photosynthesis the sun's energy is stored in the mangrove leaf. This is the first step of the energy flow in the food chain for most animals found in the estuary or lagoon. The leaf debris, detritus, is eaten by small crabs, shrimp, copepods, larvae, and plankton which are in turn eaten by larger organisms. This detritus also serves as food for bacteria and other microorganisms which are capable of breaking down cellulose and converting it into protein. The leaf litter from the mangrove has been shown to be as much as three or four tons per acre per year. This is much more than most land ecosystems found throughout the world.

The prop roots and pneumatophores of the mangrove trap debris which eventually builds up the land. They also serve as a buffer against waves which would erode the land. Thus an island in the lagoon might eventually be eroded away by wave action if it did not have mangroves growing on its shore. Also, an island with mangroves on its shoreline could possibly grow larger due to mangrove protection from waves and entrapment of debris. The pneumatophores and prop roots also keep water runoff from rains from eroding the shoreline by slowing down the rate of water flow and trapping soil which would be lost to the river.

As a habitat for plants and animals the mangrove thicket serves water-dwelling and air-dwelling organisms. The prop roots and pneumatophores give protection and serve as a nursery for many young forms of fish and other water dwelling animals. They also serve as a place for attachment for algae, oysters, barnacles, sea anemones, sponges, and other sessile organisms. Many water birds use the mangrove thicket for rookeries. In the Indian River lagoon many spoil islands covered with mangroves can be seen with pelicans, cormorants, and egrets roosting in their branches.

Martin County Schools'
Environmental Studies Center
2900 N.E. Indian River Drive
Jensen Beach, Florida 33457

5th Grade Slide Presentation

"Introduction and Vocabulary"

TEACHER - Turn projector on to "Focus" slide. Start tape. Advance slides at the audible tone or, if you are reading this aloud, where indicated by the asterisk (*). The narrative is in CAPITAL letters.

1. "Focus" slide *

2. "Credits" slide *

3. "An Environmental Study Unit on Ecosystems" FOR A BETTER UNDERSTANDING OF YOUR ENVIRONMENT AND TO PREPARE YOU FOR YOUR VISIT TO THE ENVIRONMENTAL CENTER. WE WILL LOOK AT A FEW UNITS ON THE INDIAN RIVER ECOSYSTEM. MUCH OF YOUR WORK WILL BE DONE RIGHT AT YOUR OWN SCHOOL. THERE WILL BE FOUR UNITS TO PREPARE YOU FOR YOUR VISIT TO THE CENTER. *

4. YOUR FIRST UNIT WILL COVER VOCABULARY, OR THE MEANING OF WORDS, THAT YOU WILL NEED TO KNOW. *

5. NEXT, AND VERY INTERESTING, IS A UNIT ON THE DIFFERENT ORGANISMS FOUND LIVING IN THE INDIAN RIVER LAGOON. *

6. MANY OF THE ANIMALS THAT LIVE HERE FIND EACH OTHER QUITE GOOD TO EAT. LAST YEAR YOU LEARNED ABOUT FOOD CHAINS - THIS YEAR YOU'LL LEARN ABOUT FOOD WEBS! *

7. AND OF COURSE YOU'LL LOOK AT ALL THESE UNITS TOGETHER AND SEE HOW THEY WORK TOGETHER TO MAKE UP THE ECOSYSTEM OF THE INDIAN RIVER LAGOON. *

8. MOST OF THIS YEAR'S WORK COULD TAKE YOU DEEP INTO THE INDIAN RIVER LAGOON. SINCE YOU'LL BE WORKING IN A LAGOON PERHAPS YOU WOULD LIKE TO KNOW JUST WHAT MAKES THE INDIAN RIVER A LAGOON. *

9. A LAGOON IS A BODY OF WATER THAT IS SEPARATED FROM THE SEA BY LARGE SAND BARS, REEFS, OR ISLANDS. (Pause) IN THIS PICTURE YOU CAN SEE IN THE BACKGROUND, THAT HUTCHINSON ISLAND -- WHERE THE PUBLIC BEACHES OF STUART AND JENSEN BEACH

ARE LOCATED -- SEPARATES THE INDIAN RIVER FROM THE OPEN SEA. LIVING WITHIN THIS LAGOON ARE NUMEROUS COMMUNITIES. *

10. WHEN PLANTS AND ANIMALS LIVE AND WORK TOGETHER THEY FORM A COMMUNITY, THEY ARE DEPENDENT ON THEIR SURROUNDINGS FOR MANY THINGS. THEY NEED SUNLIGHT, OXYGEN AND MANY MORE NON-LIVING THINGS. *

11. THE WORKING TOGETHER OF THE LIVING, OR BIOTIC COMMUNITIES, WITH THE NON-LIVING, OR PHYSICAL FACTORS AROUND THEM, IS CALLED AN ECOSYSTEM. (Pause) THE ENTIRE INDIAN RIVER MIGHT BE CONSIDERED AN ECOSYSTEM. THERE ARE MANY PHYSICAL FACTORS THAT CAN INFLUENCE THE GROWTH OF ORGANISMS IN ANY ECOSYSTEM. (Pause) LET'S LOOK AT SOME OF THESE PHYSICAL FACTORS AND SEE HOW THEY CAN AFFECT THE ECOSYSTEM. *

12. SALINITY, THE AMOUNT OF SALT IN THE WATER, IS A PHYSICAL FACTOR THAT CAN CAUSE THE MANGROVES TO THRIVE AND GROW INTO LUSH VEGETATION OR TO DIE AND ALLOW THE SHORELINE TO BE WASHED AWAY BY THE CURRENTS. THE AMOUNT OF SALT IN WATER CAN BE FOUND IN A NUMBER OF WAYS. *

13. OBVIOUSLY, TASTING THE WATER CAN GIVE YOU AN IDEA BUT NOT THE CORRECT AMOUNT. *

14. THESE TWO BLOCKS ARE OF EQUAL WEIGHT. ONE IS IN FRESH WATER - THE OTHER IS IN SALTY WATER. (Pause) DO YOU NOTICE THAT THE ONE IN THE SALTY WATER IS FLOATING HIGHER THAN THE ONE IN THE FRESH WATER? (Pause) THE SALTIER THE WATER THE HIGHER THE BLOCK WOULD FLOAT. AT THE ENVIRONMENTAL CENTER WE USE A FLOATING INSTRUMENT TO TELL US THE SALINITY OF WATER. *

15. THIS FLOATING INSTRUMENT USED TO FIND THE SALINITY OF WATER IS A HYDROMETER. *

16. HERE IS A PICTURE OF A HYDROMETER LIKE YOU WILL BE USING. *

17. THE HIGHER THE HYDROMETER FLOATS, THE HIGHER THE SALINITY OF THE WATER. *

18. THE HEIGHT AT WHICH THE HYDROMETER IS FLOATING IS NOTED AND THEN LOOKED UP ON A CHART WHICH GIVES THE CORRECT SALINITY. (Pause) A PHYSICAL FACTOR JUST AS IMPORTANT AS SALINITY IS THE CURRENT. *

19. CURRENTS ARE SIMPLY THE MOVEMENT CAUSED BY FLOWING WATER. THE MOVEMENTS CAN BE FROM SUCH THINGS AS WINDS, TIDES, GRAVITY, OR EVEN WAVES ON THE BEACH. *

20. SOMETIMES IT IS EASIER TO SEE THE CURRENTS THAN AT OTHER TIMES. IN THIS PICTURE YOU CAN TELL THERE IS A STRONG FLOW OF WATER BY LOOKING AT THE BUOY. *

21. FROM THIS AERIAL PICTURE OF A SECTION NEAR THE ST. LUCIE INLET, YOU CAN SEE THE EFFECT THAT THE CURRENTS HAVE HAD ON THE SURROUNDING GRASSFLATS AND SANDBARS. *

22. TURBIDITY IS ANOTHER PHYSICAL FACTOR THAT CAN AFFECT THE INDIAN RIVER LAGOON. *

23. TURBIDITY MEANS -- HOW CLOUDY THE WATER IS. THIS TURBIDITY IS USUALLY CAUSED BY MUD OR SAND PARTICLES SUSPENDED IN THE WATER. *

24. THIS WATER IS CLOUDY SO WE WOULD SAY THAT IT IS TURBID. *

25. THIS WATER IS MUCH CLEARER AND IS NOT AS TURBID. HOW COULD TURBIDITY AFFECT ANY OF THE ECOSYSTEMS OF THE INDIAN RIVER? (Pause) TURBIDITY CAN AFFECT THE GROWTH OF THE GRASSFLAT. IF THE WATER ISN'T CLEAR ENOUGH THE SUN'S LIGHT CANNOT PENETRATE THE WATER AND THE GRASSES AND ALGAE CANNOT GROW. IF THE WATER IS AS CLEAR AS IS SHOWN HERE, THEY WILL THRIVE AND GROW EVEN IN DEEP WATER. THE GRASSES ARE NOT ONLY HOME TO A MULTITUTDE OF ANIMALS, THEY ARE ALSO IMPORTANT PRODUCERS IN THE INDIAN RIVER. *

26. PRODUCERS ARE ORGANISMS THAT CAN MAKE AND STORE THEIR OWN FOOD. MOST PRODUCERS ARE PLANTS AND ARE USUALLY GREEN. THE GREEN COLOR IS THE CHLOROPHYLL THAT IS FOUND IN PRODUCERS. *

27. IT IS THE CHLOROPHYLL IN THESE PRODUCERS THAT HELP CHANGE THE SUN'S ENERGY INTO FOOD FOR THE PLANTS. *

28. SOME PRODUCERS LIKE THE RED AND BROWN ALGAE ARE NOT GREEN BUT STILL CONTAIN LARGE AMOUNTS OF CHLOROPHYLL. WHAT DO YOU THINK ARE SOME OTHER PRODUCERS IN THE INDIAN RIVER LAGOON? *

29. SOME OF THE WORLD'S MOST IMPORTANT PRODUCERS CAN BE FOUND BY LOOKING AT SOME RIVER OR OCEAN WATER UNDER A MICROSCOPE. THERE YOU CAN SEE TINY PLANTS AND ANIMALS. *

30. THESE LITTLE PLANTS AND ANIMALS ARE CALLED PLANKTON. PLANKTON IS TO THE SEA WHAT GRASS IS TO THE LAND - THE BASIC FOOD. *

31. THE PLANTS IN PLANKTON ARE CALLED PHYTOPLANKTON. THEY ARE THE MOST IMPORTANT PRODUCERS IN THE WATER. *

32. ANIMALS IN PLANKTON ARE KNOWN AS ZOOPLANKTON. SOME ZOOPLANKTON ARE ANIMALS THAT REMAIN SMALL, OTHERS ARE THE LARVAL FORM OF LARGER ANIMALS. *

33. LARVA IS A YOUNG STAGE OF LIFE OF SOME ANIMALS. USUALLY WHEN THE ANIMAL IS IN THIS STAGE OF LIFE THEY DO NOT RESEMBLE THEIR PARENTS. *

34. THIS ALMOST TRANSPARENT LARVA BUTTERFLY FISH IS ABOUT 3/8" LONG AND HARDLY RESEMBLES THE BEAUTIFUL ADULT FORM SEEN IN THE NEXT PICTURE. *

35. THE LARVA IS USUALLY FOUND IN THE OPEN SEA. HOWEVER AS AN ADULT THE BUTTERFLY FISH LIVES IN THE SHALLOW WATERS OF THE CORAL REEF COMMUNITY. *

36. CAN YOU GUESS WHAT LARGE GAME AND FOOD FISH THIS LARVA WILL GROW INTO? *

37. THIS IS THE ADULT FORM OF THE MARLIN LARVA YOU JUST SAW. IT IS EASY TO UNDERSTAND HOW LARVA AND ZOOPLANKTON NEED LARGE AMOUNTS OF FOOD TO CONTINUE LIFE AND GROW INTO SUCH LARGE ANIMALS. ZOOPLANKTON ARE USUALLY THE FIRST CONSUMERS IN THE MARINE FOOD WEB. *

38. A CONSUMER IS ANY ANIMAL THAT EATS OTHER ANIMALS AND/OR PLANTS. *

39. THERE ARE SOME CONSUMERS, LIKE THIS GRASSHOPPER, THAT DO NOT EAT ANYTHING BUT PLANTS. *

40. THEY ARE CALLED HERBIVORES. *

41. CARNIVORES ARE CONSUMERS WHICH EAT ONLY MEAT. *

42. THIS SNAKE ATTACKING AN UNSUSPECTING FROG IS A CARNIVORE. THERE ARE, OF COURSE, MANY CONSUMERS WHICH EAT BOTH PLANTS AND ANIMALS. *

43. THE WORDS WE HAVE COVERED GIVE NAMES TO IDEAS AND MEANINGS. THEY WILL BE USEFUL IN YOUR WORK AT THE ENVIRONMENTAL CENTER AND MAKE A REWARDING ADDITION TO YOUR VOCABULARY.

(The End)

TEACHER - Please rewind tape for next use. Thanks.

5th Grade Slide Presentation

"Organisms"

TEACHER - Turn projector on to "Focus" slide. Start tape. Advance slides at the audible tone or, if you're reading this aloud, where indicated by the asterisk (*). The narrative is in CAPITAL letters.

1. "Focus" slide *
2. "Credits" slide *
3. "An Environmental Study Unit on Ecosystems" *
4. "Organsims". THERE ARE MANY PLANTS AND ANIMALS THAT HELP MAKE UP AN ECOSYSTEM SUCH AS THE INDIAN RIVER LAGOON. IN THE FOLLOWING SLIDES WE WILL LOOK AT JUST A FEW OF THESE ORGANISMS, WHERE THEY LIVE, WHAT THEY EAT AND THE PART THEY PLAY IN THE WEB OF LIFE. *
5. AS ODD AS IT MAY SEEM MANY ANIMALS IN THE FOOD WEB START OUT BY EATING THIS DECAYING PLANT AND ANIMAL MATERIAL CAUGHT AMONG THE MANGROVE ROOTS. THIS DECAYING MATTER IS CALLED DETRITUS. *
6. THE FIDDLER CRAB IS A SCAVENGER THAT LIVES BOTH ON LAND AND IN THE WATER. DETRITUS IS A FAVORITE FOOD OF THE FIDDLER CRAB - THE FIDDLER CRAB HOWEVER IS A FAVORITE FOOD OF THE SHEEPSHEAD. *
7. SHEEPSHEAD EAT ANIMALS LIKE THE FIDDLER CRAB, SHRIMP, AND SOME VERY HARD SHELLED ANIMALS SUCH AS MUSSELS AND BARNACLES. THEY HAVE STRONG JAWS WHICH HELP THEM BREAK OPEN THE HARD SHELLS TO GET THE ANIMAL INSIDE. *
8. ANIMALS SUCH AS MUSSELS, OYSTERS AND CLAMS ALL BELONG TO A GROUP OF ANIMALS CALLED MOLLUSKS, MOST OF WHICH HAVE HARD SHELLS. BARNACLES HAVE HARD SHELLS EVEN THOUGH THEY ARE NOT MOLLUSKS. THEY BUILD THEIR HARD HOMES ADOUND THEMSELVES AND ARE MORE RELATED TO THE CRAB AND SHRIMP. *
9. BARNACLES FIND PILINGS AND SEAWALLS VERY FAVORABLE PLACES IN WHICH TO LIVE. SO QUITE OFTEN PEIPLE FISHING FOR SHEEPSHEAD, FISH AROUND BRIDGE PILINGS. SOME WITH VERY GOOD LUCK! *

10. NOW THAT YOU KNOW HOW THE SHEEPSHEAD GETS ITS FOOD - HOW DO YOU THINK ANIMALS LIKE OYSTERS, CLAMS, AND BARNACLES GET THEIR FOOD?!! (Pause) THEY GET THEIR FOOD BY FILTERING IT FROM THE WATER. THEIR FOOD IS MICROSCOPIC PLANTS AND ANIMALS. DO YOU KNOW THE NAME GIVEN TO THESE PLANTS AND ANIMALS? *

11. THEY ARE CALLED PLANKTON. *

12. PLANKTON IS SO SMALL THAT YOU WOULD NEED A MICROSCOPE TO CLEARLY SEE IT. *

13. UNDER THE MICROSCOPE YOU COULD SEE MANY LITTLE PLANTS - MOST OF WHICH ARE GREEN. THE PLANTS ARE CALLED PHYTOPLANKTON AND ARE THE MOST IMPORTANT PRODUCERS IN THE WATER! PHYTOPLANKTON IS THE BEGINNING OF THE MARINE FOOD WEB. *

14. ANIMALS FOUND IN PLANKTON ARE CALLED ZOOPLANKTON. IN ZOOPLANKTON THERE ARE A LOT OF LARVAE, OR YOUNG FORMS OF BIGGER ANIMALS. *

15. THIS IS THE LARVA OF A CRAB *

16. ANOTHER CURIOUS CREATURE THAT FEEDS ON PLANKTON IS THE SEA SQUIRT. THESE SEA SQUIRTS WERE PHOTOGRAPHED WHILE STILL UNDER THE WATER. DO YOU SEE THE OPENING ATOP EACH SEA SQUIRT? (Pause) THAT'S WHERE THE SEA SQUIRTS TAKE IN WATER AND FILTER IT FOR THEIR FOR THEIR FOOD. *

17. BY TOUCHING THIS ANIMAL IT IS EASY TO SEE HOW IT OBTAINED ITS NAME. WHEN TOUCHED THEY WILL CLOSE RAPIDLY AND OFTEN SQUIRT A LONG STREAM OF WATER. THESE SEA SQUIRTS HAVE ALREADY CLOSED. *

18. THE FLOUNDER IS ANOTHER INTERESTING ANIMAL THAT LIVES IN THIS AREA. WHEN FLOUNDERS ARE VERY YOUNG - A WEEK OR SO - THEY LOOK SOMEWHAT LIKE A NORMAL FISH, AS YOU SEE HERE. THEY HAVE AN EYE ON EACH SIDE OF THEIR HEAD. AS THEY GROW OLDER THEIR EYES MOVE TO ONE SIDE AND THEY BEGIN TO SWIM AND LIE ON THE BOTTOM - SIDEWAYS! *

19. THERE IS A FLOUNDER HIDING IN THIS PICTURE. CAN YOU SEE HIM? (Pause) *

20. WELL, HERE IS THE SAME FLOUNDER EXCEPT ON A ROCK. SINCE FLOUNDERS SPEND MOST OF THEIR LIFE FLAT AGAINST THE BOTTOM, ONLY ONE SIDE HAS MUCH COLOR. *

21. WHILE ONE SIDE IS USUALLY SANDY COLORED THE OTHER SIDE IS ALMOST COMPLETELY WHITE. FLOUNDER FEED MOSTLY ON SMALL FISH FOUND APOUND THE MANGROVES AND THE GRASSFLATS. *

22. THE GRASSFLATS OF THE INDIAN RIVER ECOSYSTEM ARE MAINLY SHOAL AND MANATEE GRASS. *

23. SHOAL GRASS HAS THIN, FLAT BLADES AND MANATEE HAS LONGER, MORE ROUNDED BLADES. THE GRASSES HOLD THE SOIL IN PLACE AND MAKE A HOME FOR HUNDREDS OF SMALL FISH. ALGAE ALSO GROWS WELL AMONG THE GRASSFLATS AND IS EATEN BY NUMEROUS ANIMALS. *

24. ONE OF THE ANIMALS THAT EATS THE ALGAE IS THE MULLET. MULLET ARE VEGETARIANS OR HERBIVORES - THAT IS THEY DO NOT EAT MEAT. THEY EAT THE ALGAE THAT GROWS IN THE SHALLOW RIVER WATERS. SINCE MULLET DO NOT EAT MEAT, IT IS VERY HARD TO CATCH THEM ON HOOKS. HOW DO YOU THINK YOU WOULD CATCH MULLET? *

25. THAT'S RIGHT. YOU COULD USE A CAST NET. MULLET ARE CAUGHT AND EATEN BY MAN, BIRDS, AND MANY OTHER FISH. *

26. THE FILE FISH IS STILL ANOTHER FISH OF THIS AREA THAT EATS PLANTS AND SOME SMALL ANIMALS. FILE FISH HAVE SUCH TOUGH SKINS AND HARD SCALES THAT THEY WERE AT ONE TIME USED AS SANDPAPER. THAT IS HOW THEY BECAME KNOWN AS FILEFISH. *

27. ONE OF THE LARGER FISH WHICH EATS FILE FISH AND MULLET IS THE SNOOK. THIS WOMAN PROUDLY DISPLAYS A SNOOK SHE CAUGHT USING A BRIGHT, SHINY LURE THAT RESEMBLED A MULLET. *

28. AS SNOOK GROW LARGER THEY BECOME ONE OF THE TOP PREDATORS AMONG THE MANGROVES AND GRASSFLATS. *

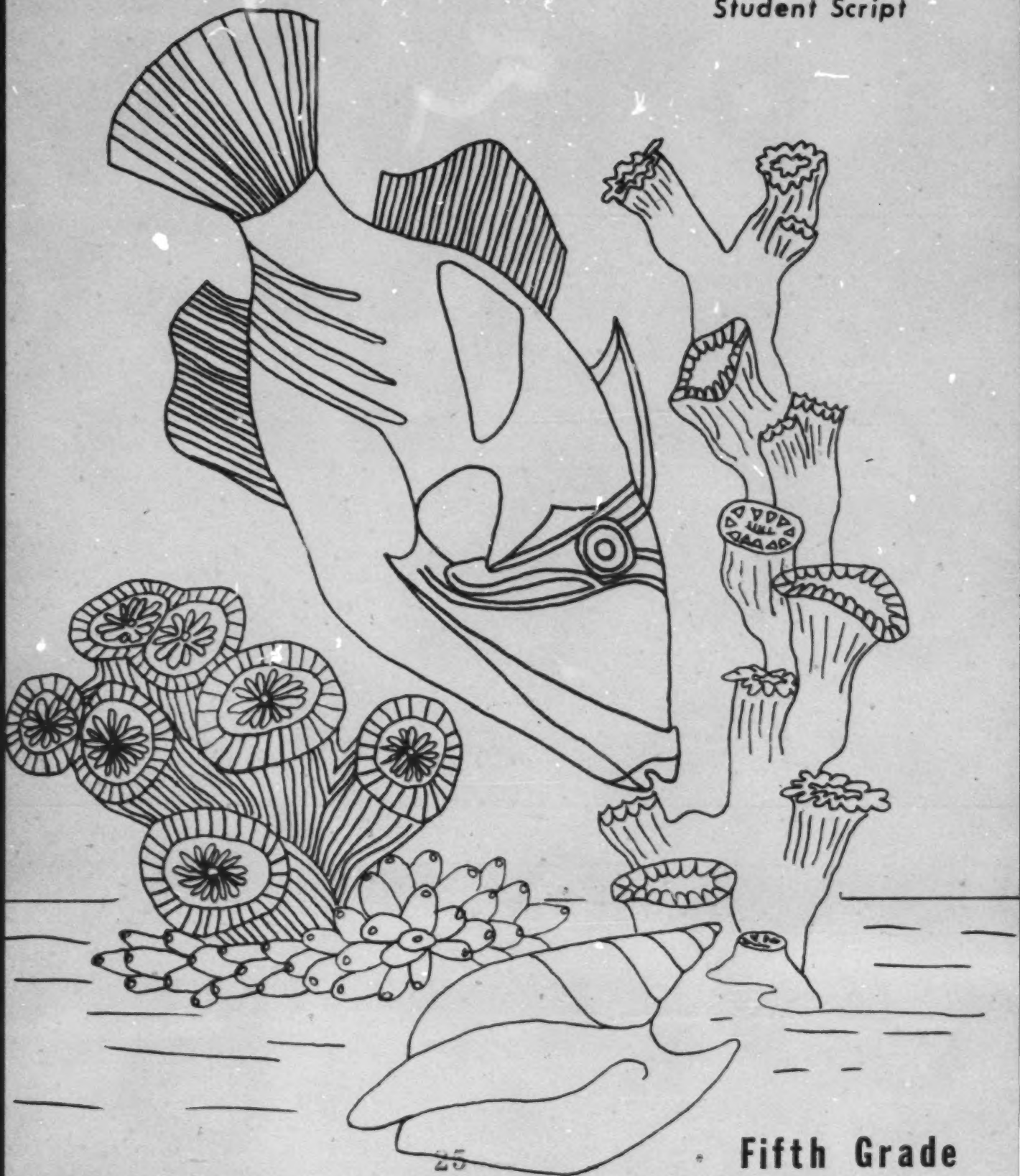
29. ALL THE ORGANISMS THAT WE HAVE JUST DISCUSSED ARE INTERRELATED IN SOME WAY AND HELP TO MAKE UP THE ECOSYSTEM OF THE INDIAN RIVER LAGOON. DURING YOUR VISIT TO THE ENVIRONMENTAL CENTER IT IS POSSIBLE THAT YOU MAY BE ABLE TO SEE SOME OR ALL OF THEM.

(The End)

TEACHER - Please rewind the tape for the next use. Thanks.

ORGANISMS of the Indian River Lagoon

Student Script



Fifth Grade

ORGANISMS OF THE INDIAN RIVER

Slide 1 - "Focus"

Slide 2 - "Credits"

Slide 3 - "Environmental Study Unit on Ecosystems"

Slide 4 - There are many plants and animals that help make up an ECOSYSTEM such as the Indian River Lagoon. In the following slides we will look at just a few of these organisms, where they live, what they eat, and the part they play in the web of life:

Slide 5 - As odd as it may seem many animals in the food web start out by eating this decaying plant and animal material caught among the mangrove roots. This decaying matter is called detritus.

Slide 6 - The fiddler crab is a scavenger that lives both on land and in the water. Detritus is a favorite food of the fiddler crab - the fiddler crab however is a favorite food of the sheepshead.

FIDDLER CRAB

Fiddler crabs are easily recognized by the one large claw which the males have. They live in holes which they dig in the sand along the water's edge. Sometimes you can see large "herds" of fiddler crabs moving among the roots of the black mangroves. They feed on detritus found in the mud.

Slide 7 - Sheepshead eat animals like the fiddler crab, shrimp, and some very hard shelled animals such as mussels and barnacles.

SHEEPSHEAD

This fish is also called a Convict fish. The average weight is about 2 pounds. It has twelve or thirteen black and white stripes around its body. The sheepshead is a popular and well known saltwater fish. It feeds on shellfish and crustaceans, while his chief enemy is larger fish and man.

They have strong jaws which help them break open the hard shells to get the animal inside.

MUSSELS

Mussels are related to oysters and clams. They also have two shells. Mussels attach by using hundreds of tiny threads. Large clumps of mussels may be found attached to red mangrove roots. They eat plankton much like the oyster does.

BARNACLE

Barnacles are relatives of the crabs and shrimp. When a barnacle is very young it swims around looking for a place to attach. Once it attaches it never can move to another place. Barnacles build around them a series of shells which form a house for them. Barnacles feed by kicking their feet into the water and catching plankton. You will find barnacles attached to the roots of red mangroves.

Slide 8 - Animals such as mussels, oysters and clams all belong to a group of animals called mollusks, most of which have hard shells. Barnacles have hard shells even though they are not mollusks. They build their hard homes around themselves and are more related to the crab and shrimp.

Slide 9 - Barnacles find roots, pilings and seawalls very favorable places in which to live. So quite often people fishing for sheepshead fish around bridge pilings. Some with very good luck!

Slide 10 - Now that you know how the sheepshead gets its food -- how do you think animals like oysters, clams, and barnacles get their food?!!

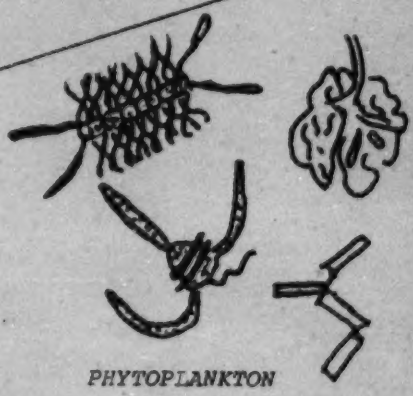
They get their food by filtering it from the water. Their food is microscopic plants and animals.

Do you know the name given to these plants and animals?

Slide 11 - They are called plankton.

Slide 12- Plankton is so small that you would need a microscope to clearly see it! Here are some pictures of plankton taken under a microscope.

Slide 13 - Under the microscope you could see many little plants - most of which are green. The plants are called phytoplankton and are the most important producers in the water! Phytoplankton is the beginning of the marine food web.

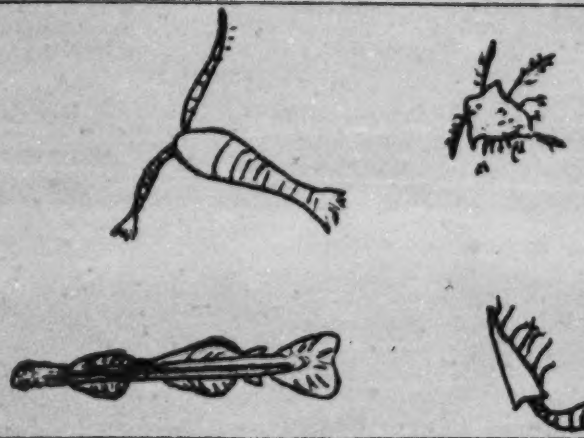


PHYTOPLANKTON

Phytoplankton are tiny, floating water plants. This grouping includes diatoms and other tiny algae forms as well as the small young stages of some of the larger, attached algae.

Slide 14 - Animals found in plankton are called Zooplankton. In Zooplankton there are a lot of larvae, or young forms of bigger animals.

Slide 15 - This is a larva of a crab...



ZOOPLANKTON

Zooplankton are tiny floating animals. This grouping includes microscopic adult animals as well as the tiny developing stages of other much larger animals.

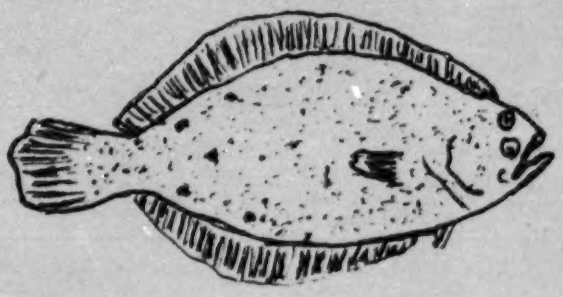
Slide 16 - Another curious creature that feeds on plankton is the sea squirt. These sea squirts were photographed while still under the water. Do you see the opening atop each sea squirt? That's where the sea squirts take in water and filter it for their food.

SEA SQUIRT

Sea Squirts look very much like sponges except they only have two openings into their body while sponges have many. They pull water in one opening and strain plankton and detritus out of the water. If you squeeze them gently they will squirt water at you. Sea squirts can be found attached to the roots of the red mangroves.

Slide 17 - By touching this animal it is easy to see how it obtained its name. When touched they will close rapidly and often squirt a long stream of water. These sea squirts have already closed.

Slide 18 - The flounder is another interesting animal that lives in this area. When flounders are very young - a week or so - they look somewhat like a normal fish. As you see here they have an eye on each side of their head. As they become older their eyes move to one side and they begin to swim and lie on the bottom - sideways!



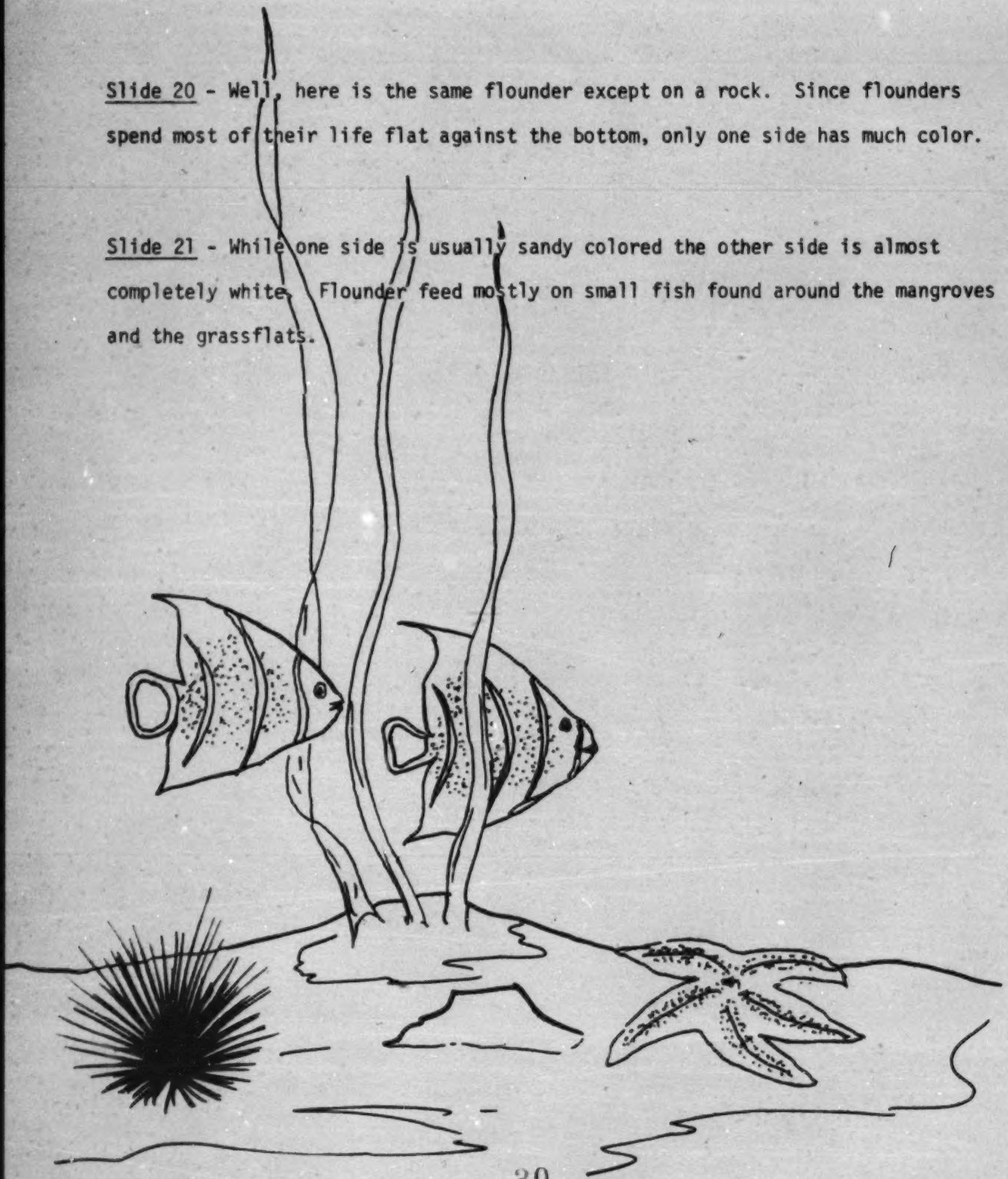
FLOUNDER

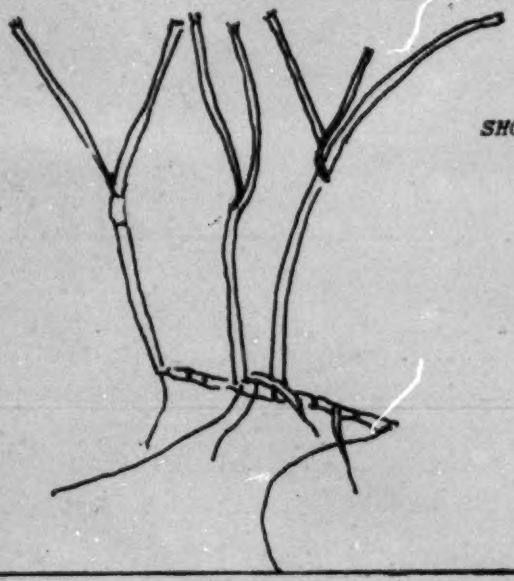
Flounder spend their life on the bottom. Only one side of their body is marked. The bottom side is white. Both eyes are on one side - the top. Flounder feed on small minnows and crabs, and are excellent food fish for man.

Slide 19 - There is a flounder hiding in this picture. Can you see him?

Slide 20 - Well, here is the same flounder except on a rock. Since flounders spend most of their life flat against the bottom, only one side has much color.

Slide 21 - While one side is usually sandy colored the other side is almost completely white. Flounder feed mostly on small fish found around the mangroves and the grassflats.





SHOAL GRASS - Shoal Grass is short, thin grass. This grass precedes the grassflats of deeper waters. Though usually covered by the tide, Shoal Grass can withstand seasonal exposure of a short duration.

The leaf itself is flat and has a blade end that is straight across with three points along its edge.

Slide 22 - The grassflats of the Indian River ecosystem are mainly shoal and manatee grass.

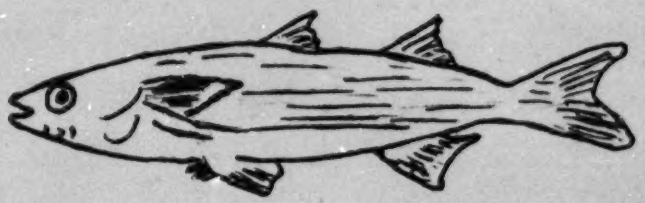
Slide 23 - Shoal grass has thin, flat blades, and manatee has longer, more rounded blades. The grasses hold the soil in place and make a home for hundreds of small fish. Algae also grows well among the grassflats and is eaten by numerous animals.

MANATEE GRASS

This grass is often found in the same areas as that of TURTLE, that is shallow waters and muddy, sandy and broken shell bottoms.

The leaf is narrow and round and there are several blades in a whorl.

Slide 24 - One of the animals that eats the algae is the mullet. Mullet are vegetarians or herbivores - that is they do not eat meat. They eat the algae that grows in the shallow river waters. Since mullet do not eat meat, it is very hard to catch them on hooks. How do you think you would catch mullet?

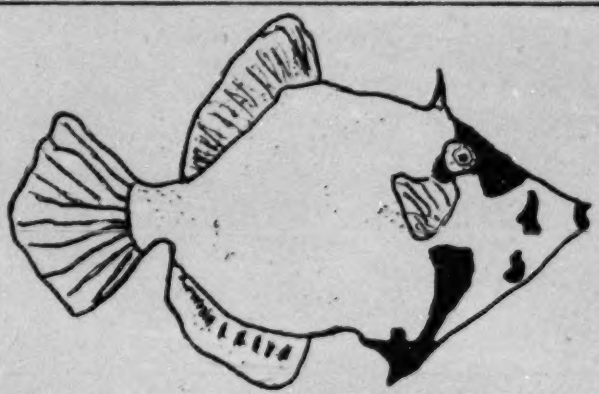


MULLET

Young mullet live in the ocean. When about an inch long, they come inshore and begin feeding on the bottom. Most are salt water fishes but some live in parts of the estuary where water is almost fresh. The fish you see jumping in the river are apt to be mullet. They feed on vegetable matter gotten from bottom detritus and are food for man, larger fish, and birds.

Slide 25 - That's right. You could use a cast net. Mullet are caught and eaten by man, birds, and many other fish.

Slide 26 - The file fish is still another fish of this area that eats plants and some small animals. File fish have such tough skins and hard scales that they were at one time used as sandpaper. This is how they became known as filefish.

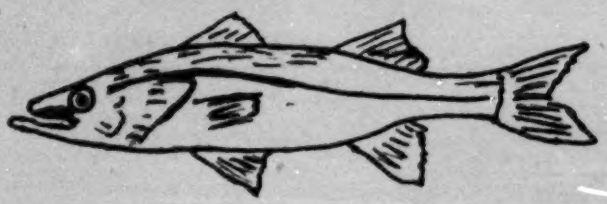


FILEFISH

The filefish is a slow swimming fish with rough leathery spotted skin. The fish is found mostly around barnacle-covered pilings, where they nip away at barnacles with their strong dog-like teeth. Because they do not move away from danger and are so slow moving, they are often called "fool fish."

The main enemies of this fish are larger fish and birds.

SNOOK



The snook is recognized by a dark stripe which runs along the side of its body from the gills to the tail. Snook are good fighting fish and can often be found feeding on smaller fish around the red mangroves.

Slide 27 - One of the larger fish which eats file fish and mullet is the snook. This woman proudly displays a snook she caught using a bright, shiny lure that resembled a mullet.

Slide 28 - As snook grow larger they become one of the top predators among the mangroves and grassflats.

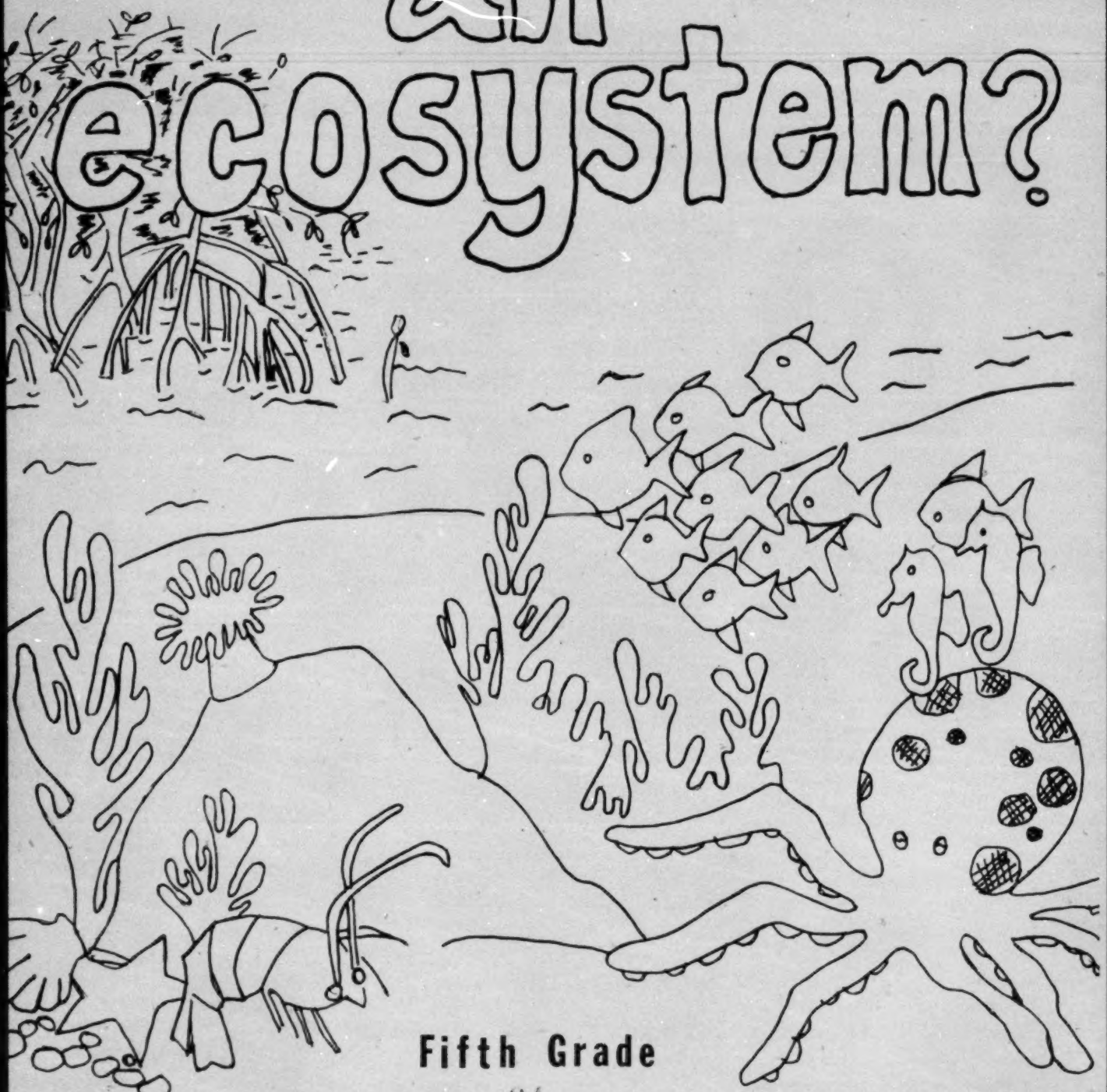
Slide 29 - All the organisms that we have just discussed are interrelated in some way and help to make up the ecosystem of the Indian River Lagoon.

During your visit to the Environmental Center it is possible that you may be able to see some or all of them.

THE END

Martin County Schools'
Environmental Studies Center
2900 N.E. Indian River Drive
Jensen Beach, Florida 33457

what is an ecosystem?



Fifth Grade

WHAT IS AN ECOSYSTEM?

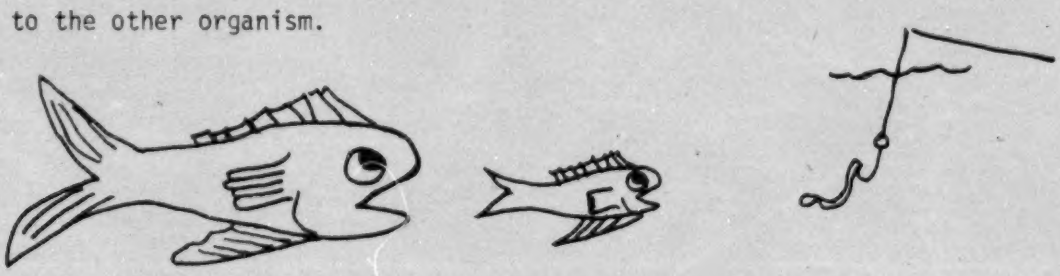
You have, in the past probably studied about different communities, such as the grassflats and the mangroves.

Now you will have a chance to see how different communities are related, or interdependent with each other and form what is called an ecosystem.

Ecosystems are made up of two parts. The first part is the non-living or physical factor. This could include things as the current, wind, sunlight, soil, temperature and salinity.

The organisms which live in the ecosystem make up the other part. It is called the biotic, or living community.

In an ecosystem the animals and plants live together because they need each other...in fact most of them could not live without one another. Organisms are there to eat and to be eaten by others. This is how the energy from one organism gets to the other organism.

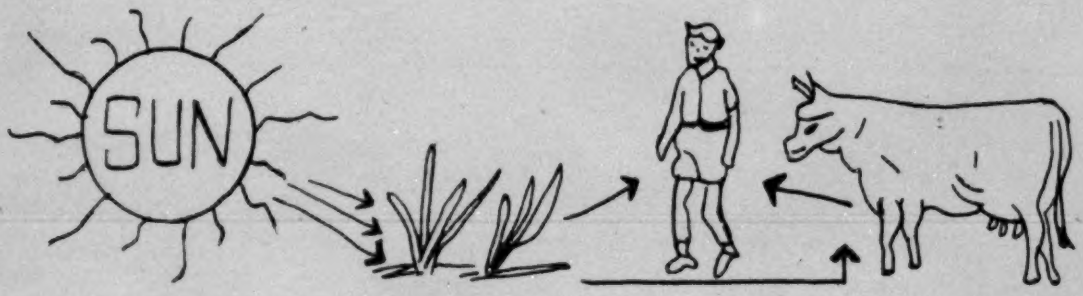


In an ecosystem all energy is just exchanged from organism to organism!

Where does all of this energy come from in the first place...? Right! The sun.

The sun supplies all energy in the beginning.

What changes the sun's energy into energy for other living organisms?... Did you say plants? Well, if you did, you were correct.



Plants use a process called Photosynthesis to make food, which is stored energy from the sun. The green plants are just the beginning of a giant food or energy web that spreads throughout the ecosystem.

From your study of grassflats in the third grade you should remember that the grassflats in this area are made of three types of grasses:

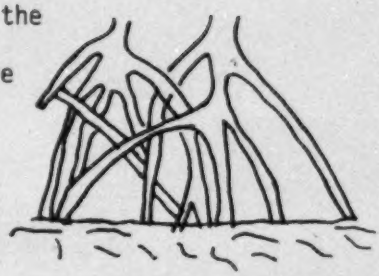
Manatee, with thin rounded blades; Shoal which has thin flat blades; Turtlegrass with its wide flat blades. You saw mostly Manatee and the Shoal grasses when you visited the Center.

Do you remember anything else about the grassflats? What about water, sunlight, and temperature? All are very important!

Probably you most recall all the different animals that lived among the grasses. Try to name as many as you can!

Last year when you went into the mangroves you saw many of the same animals. Do you know why they were there also? Of course, they were there eating and hiding among the roots.

There is a lot of food caught in the prop-roots of the Red Mangrove. It is called...Detritus. The Red Mangrove is right out in the salt water with its prop roots catching the detritus and making a home for hundreds of small animals.



The Black Mangrove was next. It had all of those little roots sticking out of the ground. They are called breather roots. Black Mangroves are covered by salt water only during high tides.

Farthest from the shore is the White Mangrove. You can tell a White Mangrove by looking at the leaf. Each oval leaf has a notch at the top.

You have probably already guessed how these two communities, the grassflats and the mangroves, are interdependent and help make up part of the ecosystem of the Indian River Lagoon.

Let's just look at one small part right now.

Suppose we look at the crab which lives among the mangroves. The larval form of the young crabs start out life in the water. They are very small and make up part of the Zooplankton. Zooplankton is the source of energy for many other animals like the clam, oyster, and shrimp.

These animals are then eaten by fish which could be eaten by some birds.

Many of these birds live and nest in the mangrove trees.

While all of this happening, the mangrove is "building" up new land for more organisms to live on.

This is just a small portion of what is going on in this ecosystem.

So you can see that plants and animals that live and work together in these two communities depend on their surroundings for many things. They need sunlight, salt water and many more things that are not living. The working together of the living things with the non-living things around them is called an ecosystem.

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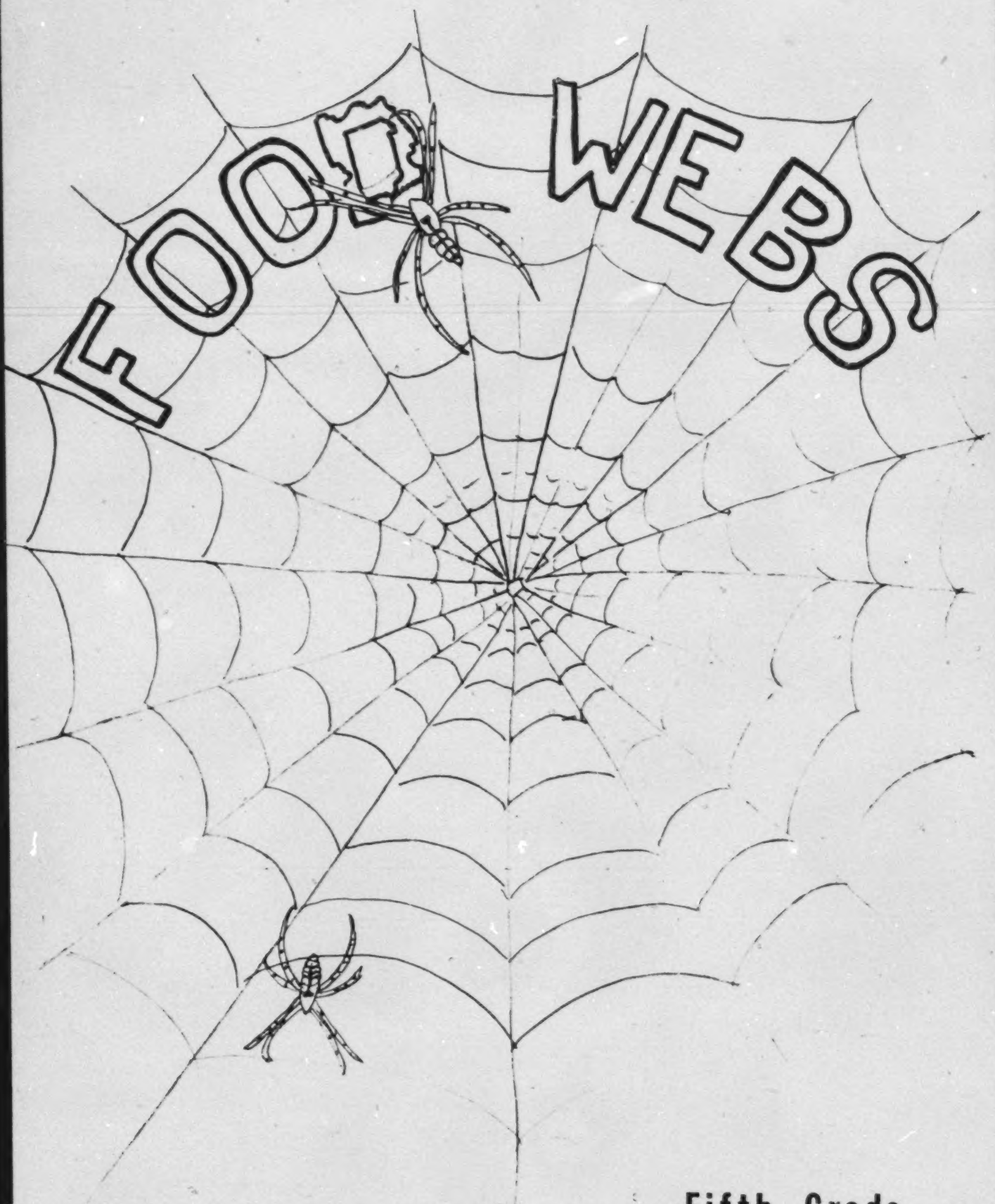
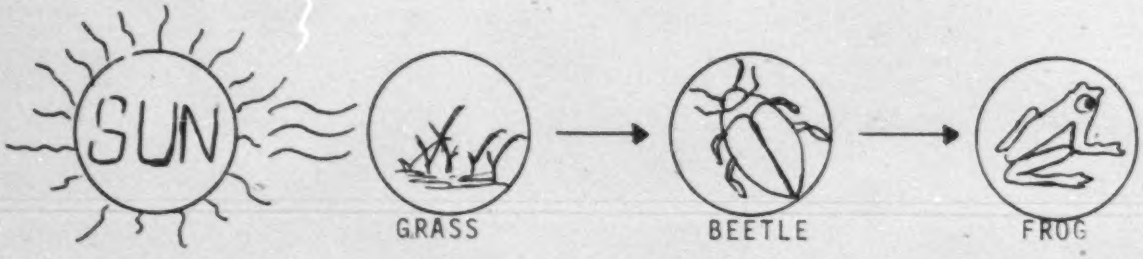


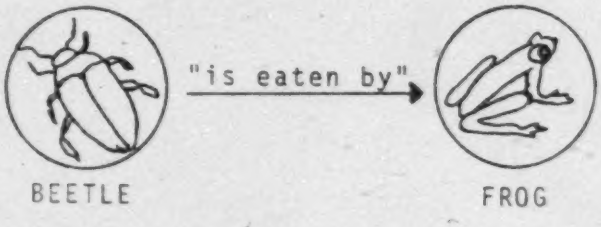
Fifth Grade

Most of you are already familiar with simple food or energy chains like the one below.



In this food chain the grass is called the Producer. Plants are the only Producers. The plants may be trees, grasses or the grassflats in the oceans and rivers, or any other green plants.

The arrow in our food chain picture shows what "is eaten by" what. The arrow always points to what is doing the eating.



The Beetle and the Frog are called Consumers. Can you guess why?

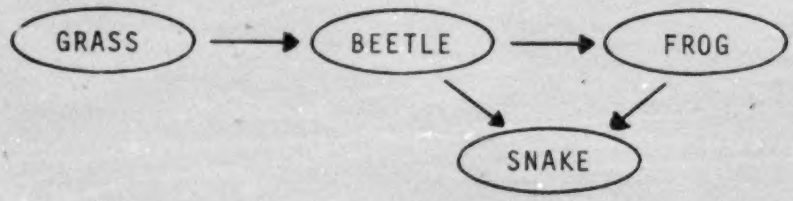
Consumers can NOT make their own energy, so they must get their energy in the form of food from either animals or plants.

Let's look back again to the grass, beetle and frog.

What do you think would happen if our friend the snake came along? What would he eat to get his energy? The Beetle? The Frog? Both?!!

Of course he could eat both. (And probably would!!)

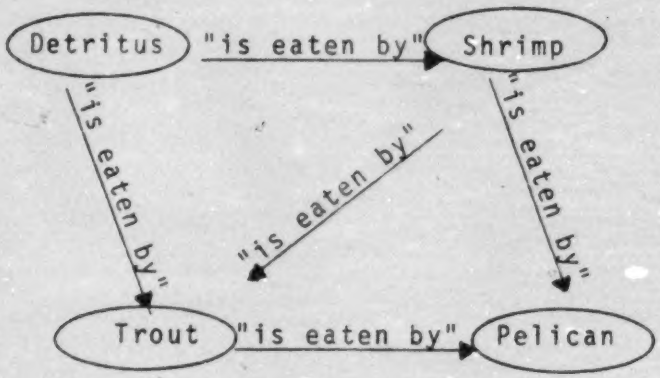
Now our energy chain is looking more like a web...an energy web.



In an Energy Web the arrows still show which way the energy is flowing. We now see that the arrows can go to more than one Consumer.

Do you remember all of the dead and decaying plants and animals among the roots of the mangroves? All this decaying material is called detritus. Many animals eat detritus. Animals like crabs, shrimp and small fish are just some of the animals that eat the detritus.

Let's just look at what could happen to some detritus, a shrimp, a fish--maybe a trout, and of course, a pelican.



WOW! Things don't look very safe for any animal in this food web, except for the pelican. The pelican doesn't have any natural enemies.

Animals that have no natural enemies are called "top predators". How do you suppose they got that name?

Can you name any other top predators in this area?

Really, most top predators do have at least one enemy. That one is MAN!

In the ecosystem of the Indian River Lagoon the Producers are not always the grassflats or the mangroves.

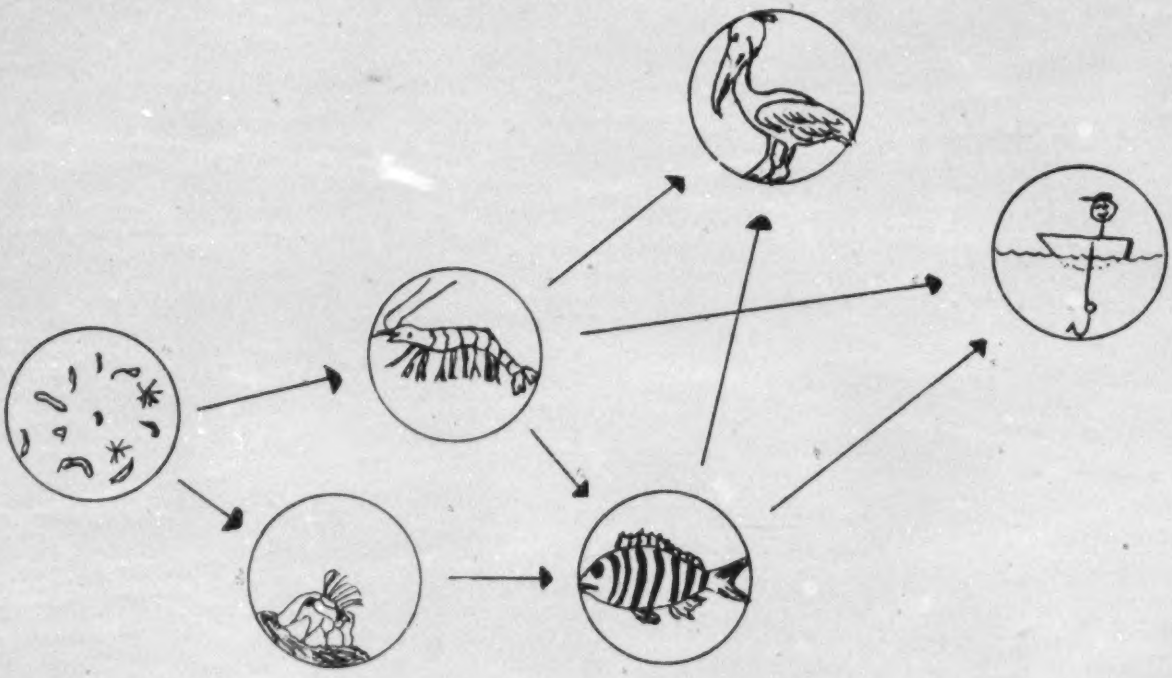
Do you know where there are millions of more plants that are Producers? They are right in the water floating around! PLANKTON.

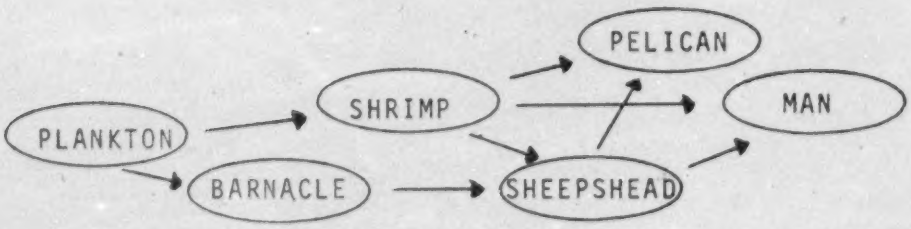
Plankton are microscopic plants and animals.

The plants are called Phytoplankton and are very important Producers. The animals in plankton are called Zooplankton.

Many organism depend on plankton for food.

Some of these are clam, oysters, barnacles, sea squirts, even some whales!





By now you can see that an ecosystem has many important parts and each part affects many others in the ecosystems.

Instructions for

"EAT AND BE EATEN"

(A Food Web Card Game)

NUMBER OF PLAYERS -- up to 6

OBJECT of the game: the first person to play out all his cards wins.

THE CARDS: There are three types of cards in the deck -- organism -- sun -- disaster. Each organism card represents an animal or plant found in the food webs of the Indian River ecosystem. The organism which the card represents is pictured in the circle. On most cards there are lists of organisms in the lower left hand and right hand corners. These will tell you which organisms the main (pictured) organism eats or is eaten by. The organisms in the lower LEFT hand corner are eaten by the main organism (pictured), while the ones in the lower RIGHT hand corner eat the main organism (pictured).

When a green plant is the main (pictured) organism, the SUN is in the LEFT hand corner, giving energy to the plant. The arrows tell you which way the energy goes. An organism card cannot be played on another card unless it is listed in the lower RIGHT or LEFT hand corners of the card on which it is to be played.

The sunshine card shows where all the energy of the food web comes from. The sun's energy passes first to green plants. Any plant organism card can be played on a sunshine card. The sunshine card can ONLY be played on a disaster card or on a plant organism card.

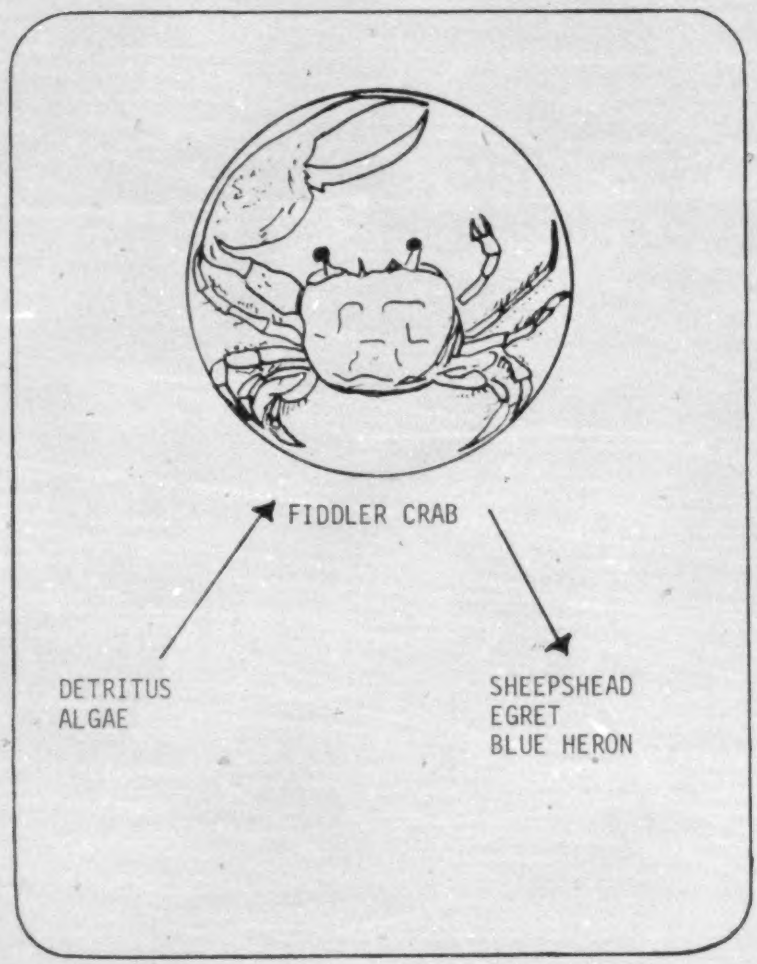
The disaster card may be played on ANY card at any time during the game as long as it is the turn of the player holding the disaster card. The ONLY card that can be played on a disaster card is a SUNSHINE CARD.

THE PLAY: Deal out six (6) cards to each of the players. Place the remaining cards face down on the table and turn the top card over, to start the playing

stack. The top card showing is the card to be played on.

The player to the left of the dealer is the first to begin. To play a card from his hand, the player MUST have a card on which the main (pictured) organism is one of the organisms that is either eaten by or eats the main (pictured) organism on the top card of the playing stack.

FOR EXAMPLE: If the card below was the top card showing on the playing stack, then the player could play one card that has as the main (pictured) organism, any of the following: DETRITUS, ALGAE, SHEEPSHEAD, EGRET OR BLUE HERON.



In the event that a player does not have a card that either eats or is eaten by the main (pictured) organism of the top card, he must draw from the deck. If a card is drawn that can by played, the player does so and the play moves on to the next person to the left. If it cannot be played, he draws again. If after the third (3rd) draw the player has not drawn a suitable card, the play moves on to the next person.

Should the players go through the entire deck on the table without a winner, the playing stack is to be RESHUFFLED. Leave the last card facing up to resume play. If time is a factor, a time limit may be placed on this card game. At the end of the time, the player with the least number of cards would be the winner. Twenty minutes is a suitable time limit.

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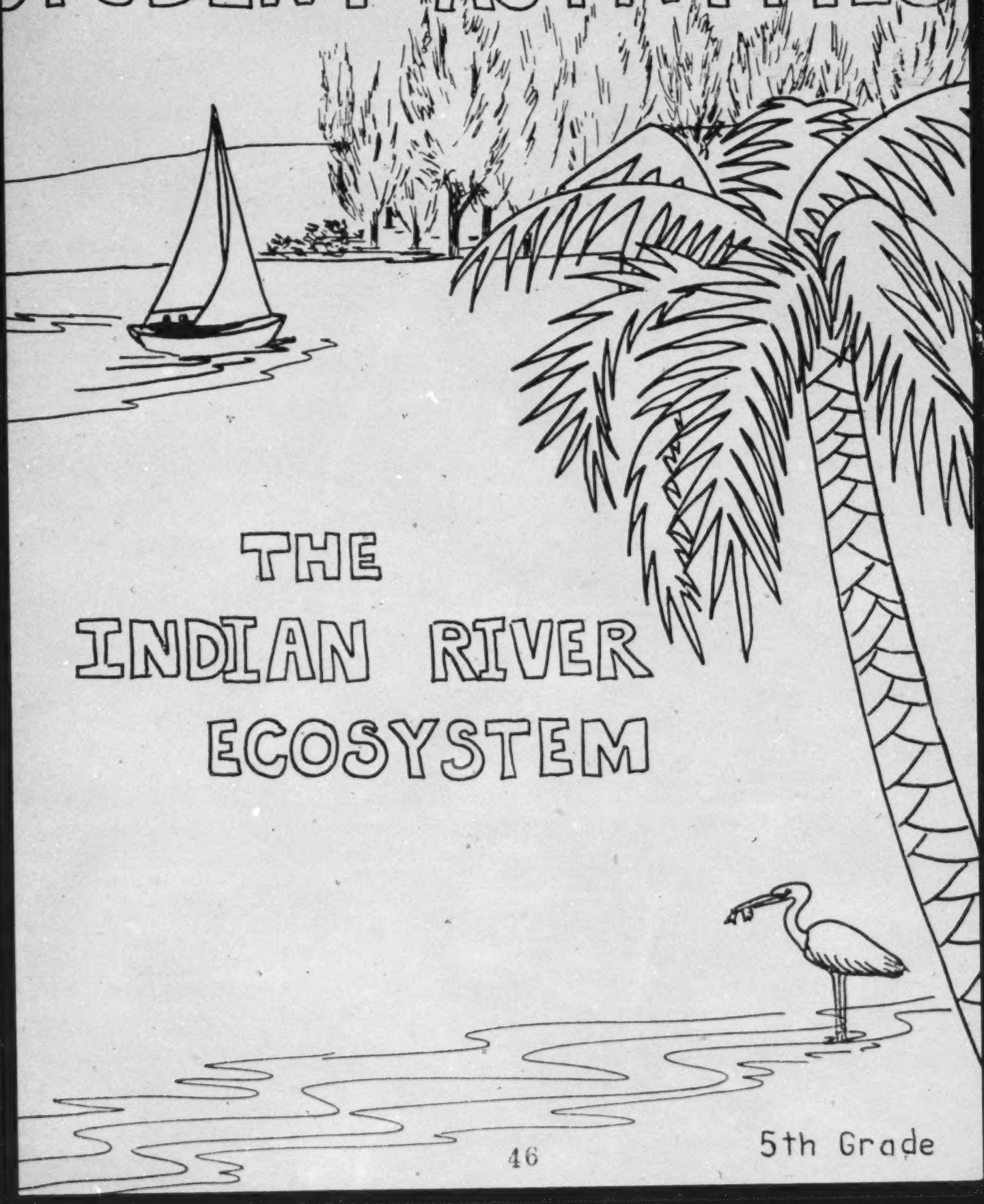
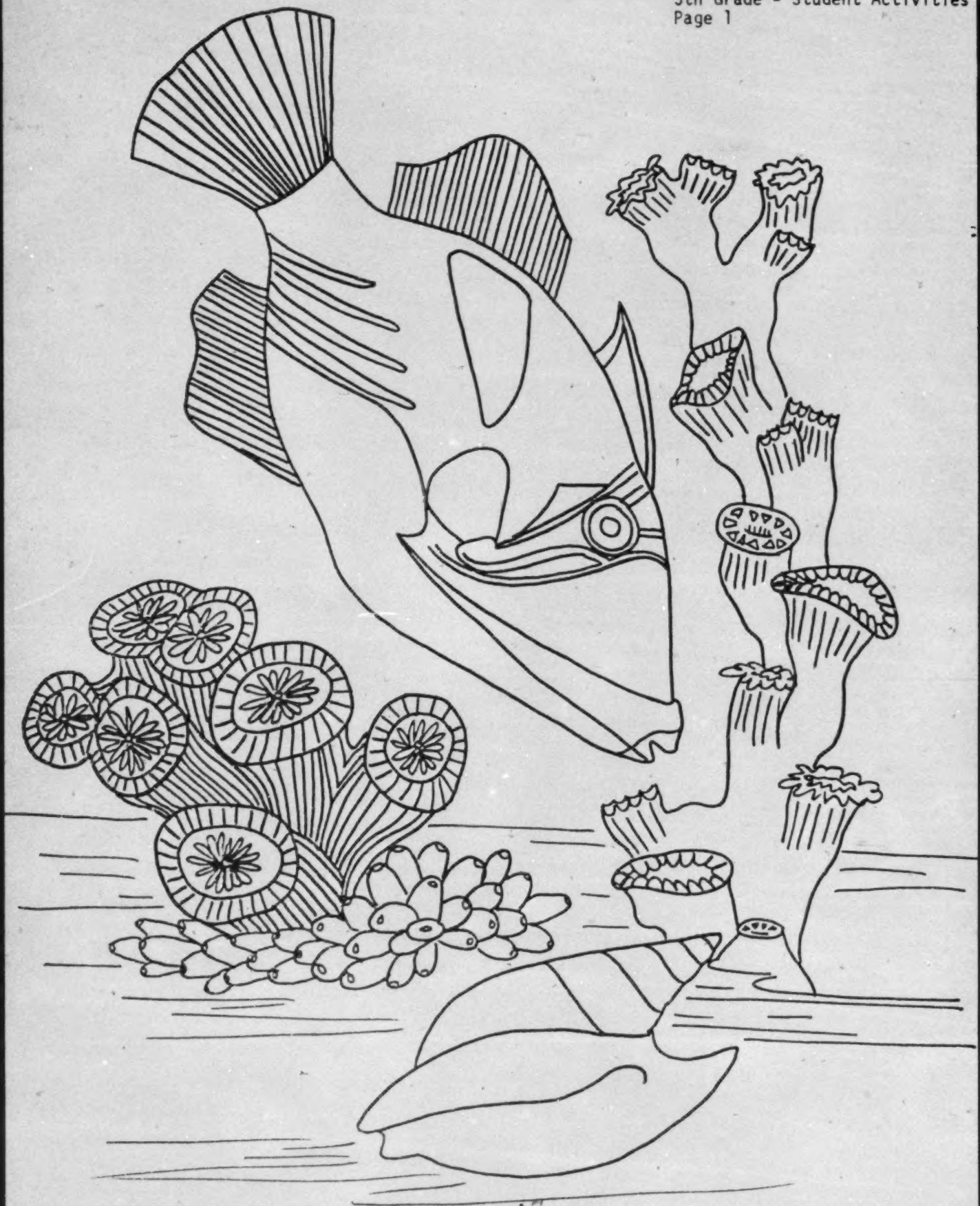
STUDENT ACTIVITIES



THE INDIAN RIVER ECOSYSTEM

5th Grade



ACROSS

1. The microscopic plants found in the water
2. Organisms that can make and store their own food
3. Microscopic organisms found in water
4. A word used to describe the cloudiness of the water
5. The swift movement of a body of water is called a _____
6. What plants and animals form, when they live and work together
7. A young stage of life of an animal when it usually does not resemble the adult animal
8. An organism that must get its energy by eating some other organism
9. The microscopic animals found in the water
10. Gives the green color to plants and helps them change the sun's energy into energy for themselves

DOWN

1. A floating intrument used to find the salinity of water
2. A body of water separated from the sea by large sand bars, reefs, or islands
3. Dead and decaying matter found caught among the mangrove roots
4. The amount of salt in the water
5. An organism that eats only plants
6. The working together of the living communities with the surrounding physical factors
7. Animals with hard shells, like mussels, oysters and clams
8. An organism that eats only meat

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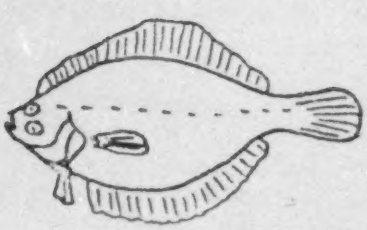
VOCABULARY CROSSWORD

1 PHYTOPLANKTON
HYDROMETER
2 PRODUCERS
GON
3 PLANKTON
SAINITY
3 DETRITUS
4 TURBIDITY
5 CURRENT
HERBIVORE
6 ECOSYSTEM
6 COMMUNITY
7 LARVA
OLUSK
8 CONSUMER
CARNIVORE
9 ZOOPLANKTON
10 CHLOROPHYLL
RE



ACROSS

1. A silvery fish that is a herbivore, used as bait and eaten by many other fish
2. A top predator fish with a dark stripe that runs the length of its body
3. A saltwater grass with small flat blades
4. A group of animals that usually has a hard outer shell
5. A saltwater grass with long thin rounded blades
6. Name given to a group of saltwater trees
7. An animal that feeds by filtering plankton from the water
8. An animal that builds a hard shell home around himself. It is related to the crab and shrimp
9. A fish which feeds on small plants and animals and has very tough scales
10. Fish with both eyes on the same side of his head
11. A large brown bird that dives into the water for its food

DOWN

1. A flat fish that has a barb on his tail
2. Microscopic plants and animals found in the water
3. The animals found in plankton
4. A tree that slows down erosion along the river's shoreline
5. A dark colored, long-legged, wading bird
6. An important producer - comes in a variety of colors
7. A black and white striped fish with very strong jaws
8. Dead and decaying matter caught among the mangrove roots
9. A large white bird found among the mangroves and river shore
10. Tiny plants found in plankton
11. Hard shelled animal found throughout the Indian River Ecosystem

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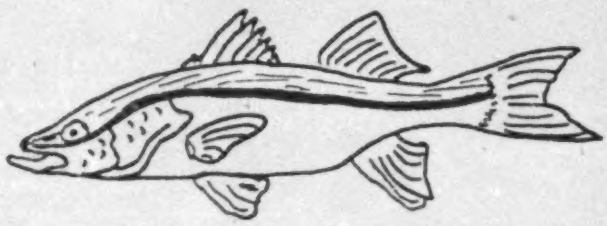
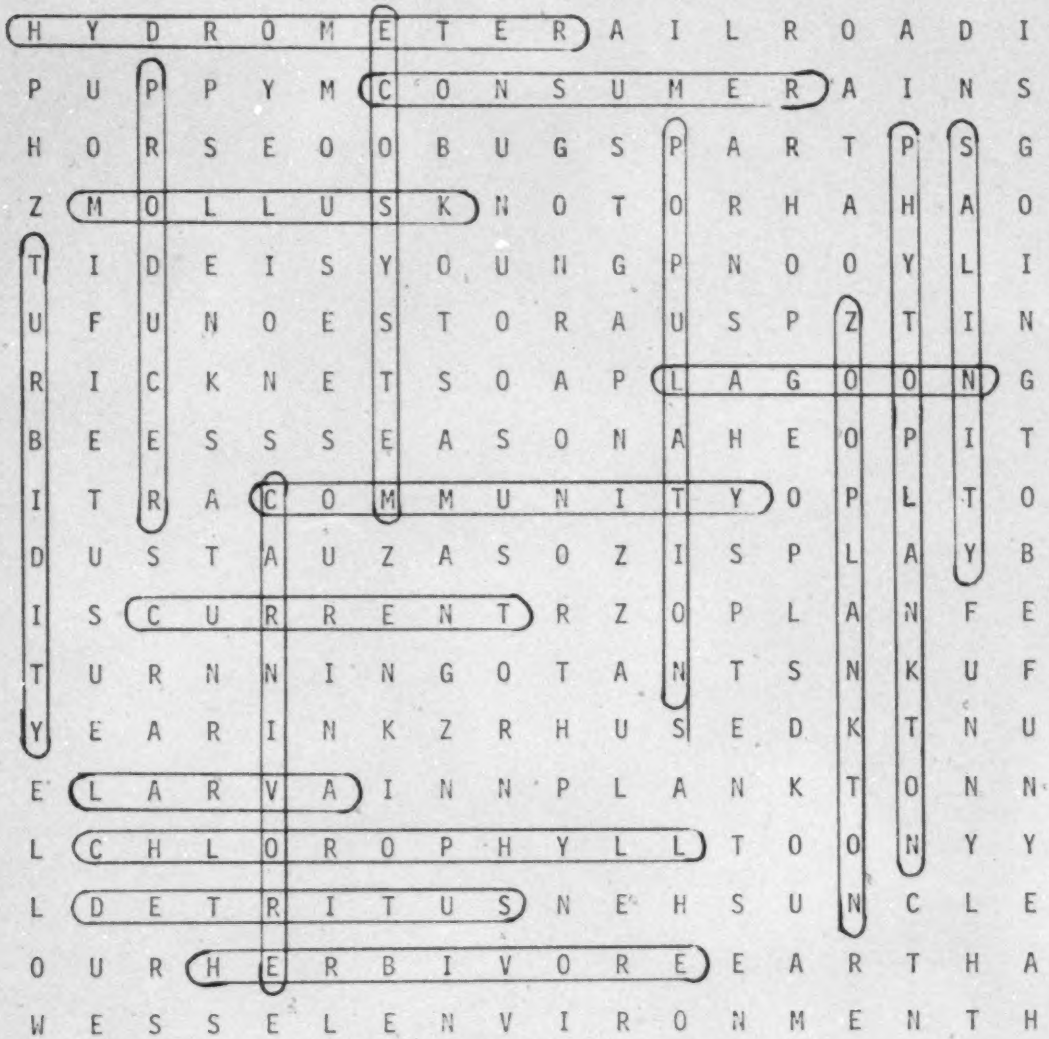
ORGANISMS CROSSWORD

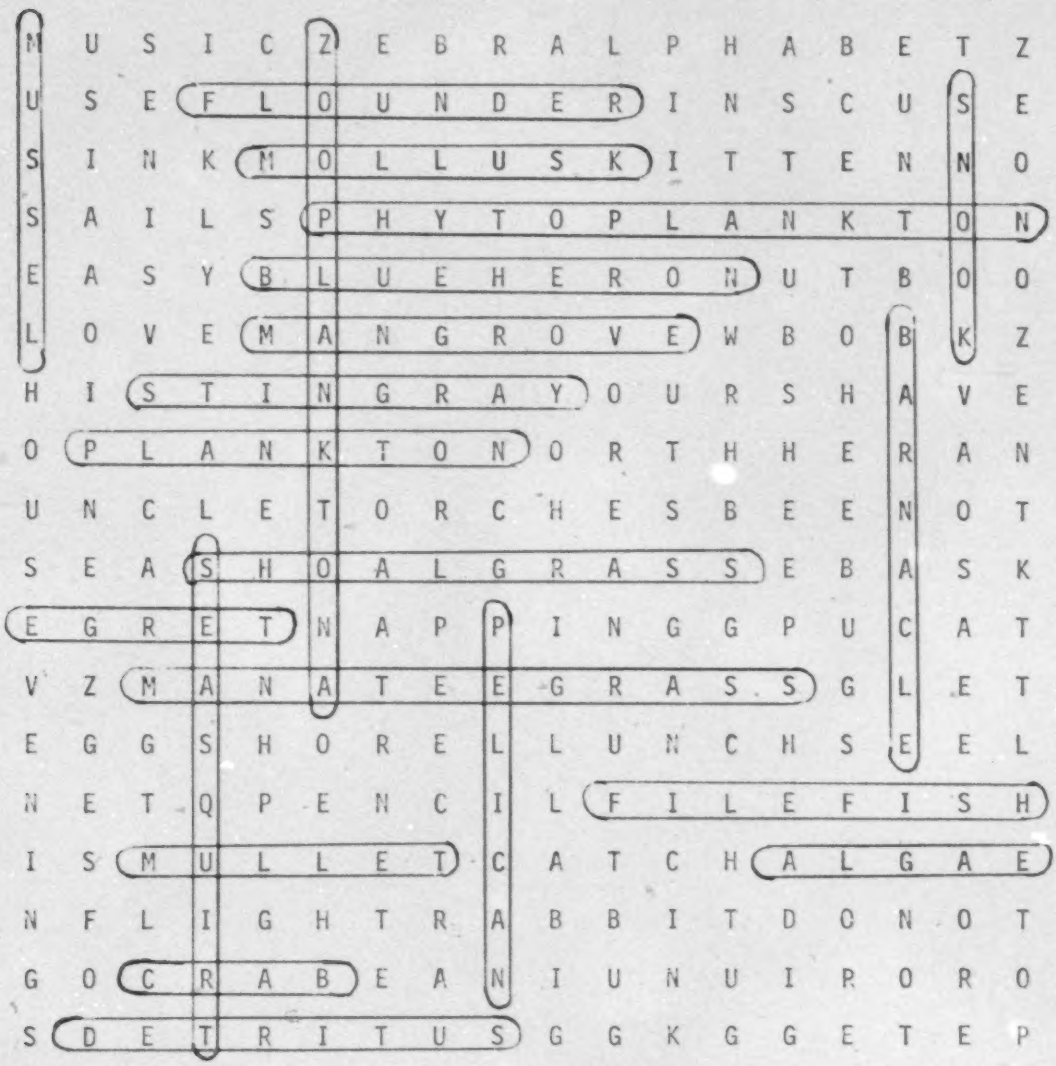


In the following WORD SEARCH see how many of the vocabulary listed below you can find. All words are spelled across the page, left to right; or down the page, top to bottom.



Hydrometer
Mollusk
Community
Larva
Plankton
Chlorophyll
Phytoplankton
Detritus
Herbivore
Consumer
Lagoon
Current
Turbidity
Zooplankton
Producer
Carnivore
Ecosystem
Population
Lagoon
Salinity

This word search contains many of the organisms you have been studying. The words are arranged in the same manner as page #5.


M U S I C Z E B R A L P H A B E T Z
U S E F L O U N D E R I N S C U S E
S I N K M O L L U S K I T T E N N O
S A I L S P H Y T O P L A N K T O N
E A S Y B L U E H E R O N U T B O O
L O V E M A N G R O V E W B O B K Z
H I S T I N G R A Y O U R S H A V E
O P L A N K T O N O R T H H E R A N
U N C L E T O R C H E S B E E N O T
S E A S H O A L G R A S S E B A S K
E G R E T N A P P I N G G P U C A T
V Z M A N A T E E G R A S S G L E T
E G G S H O R E L L U N C H S E E L
N E T Q P E N C I L F I L E F I S H
I S M U L L E T C A T C H A L G A E
N F L I G H T R A B B I T D O N O T
G O C R A B E A N I U N U I R O R O
S D E T R I T U S G G K G G E T E P

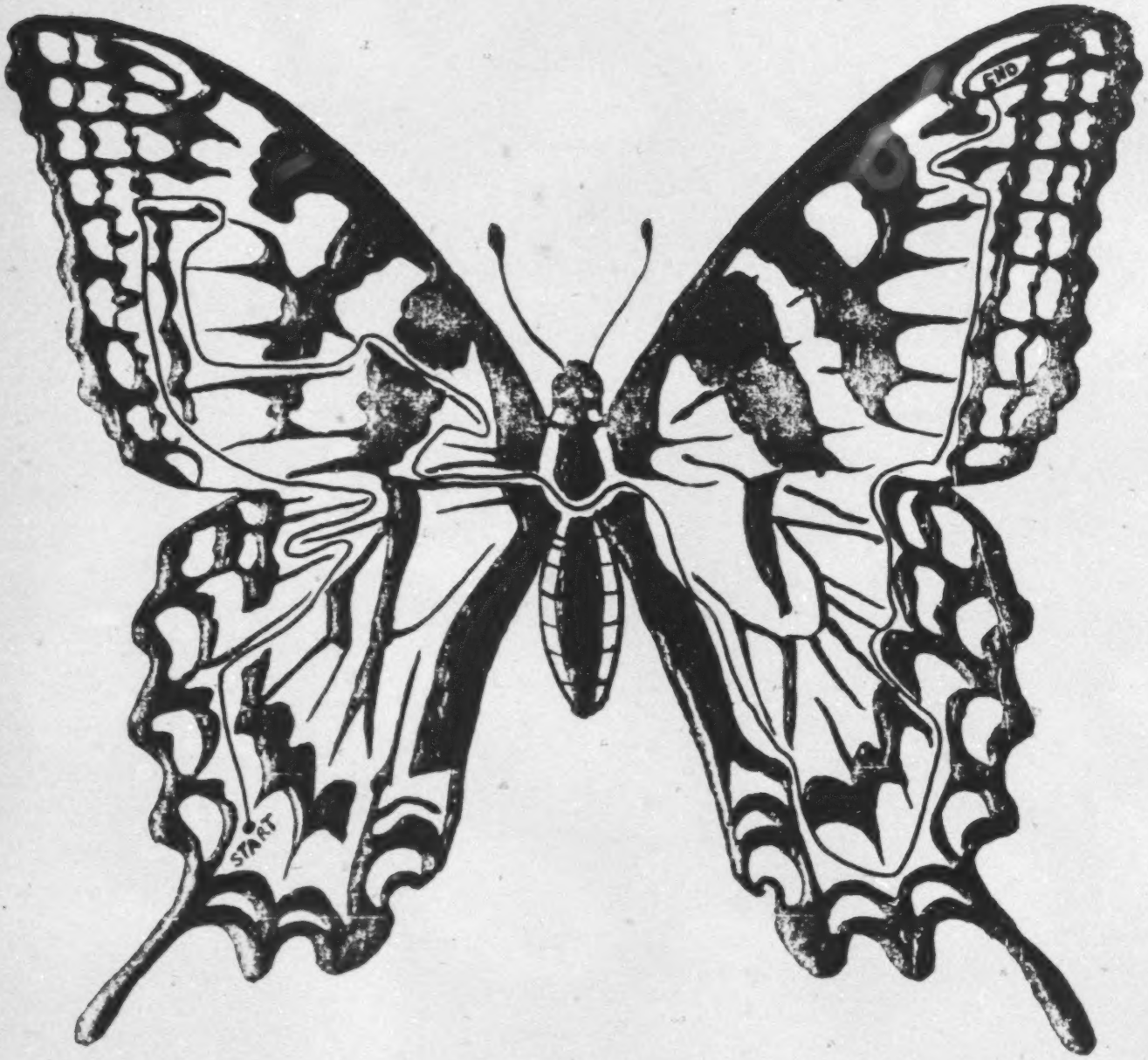
Mussel
Sea Squirt
Zooplankton
Pelican
Sheepsnead
Filefish
Stingray

Barnacle
Flounder
Mollusk
Snook
Blue Heron
Algae
Crab

Plankton
Shoal grass
Egret
Manatee grass
Mullet
Detritus
Phytoplankton

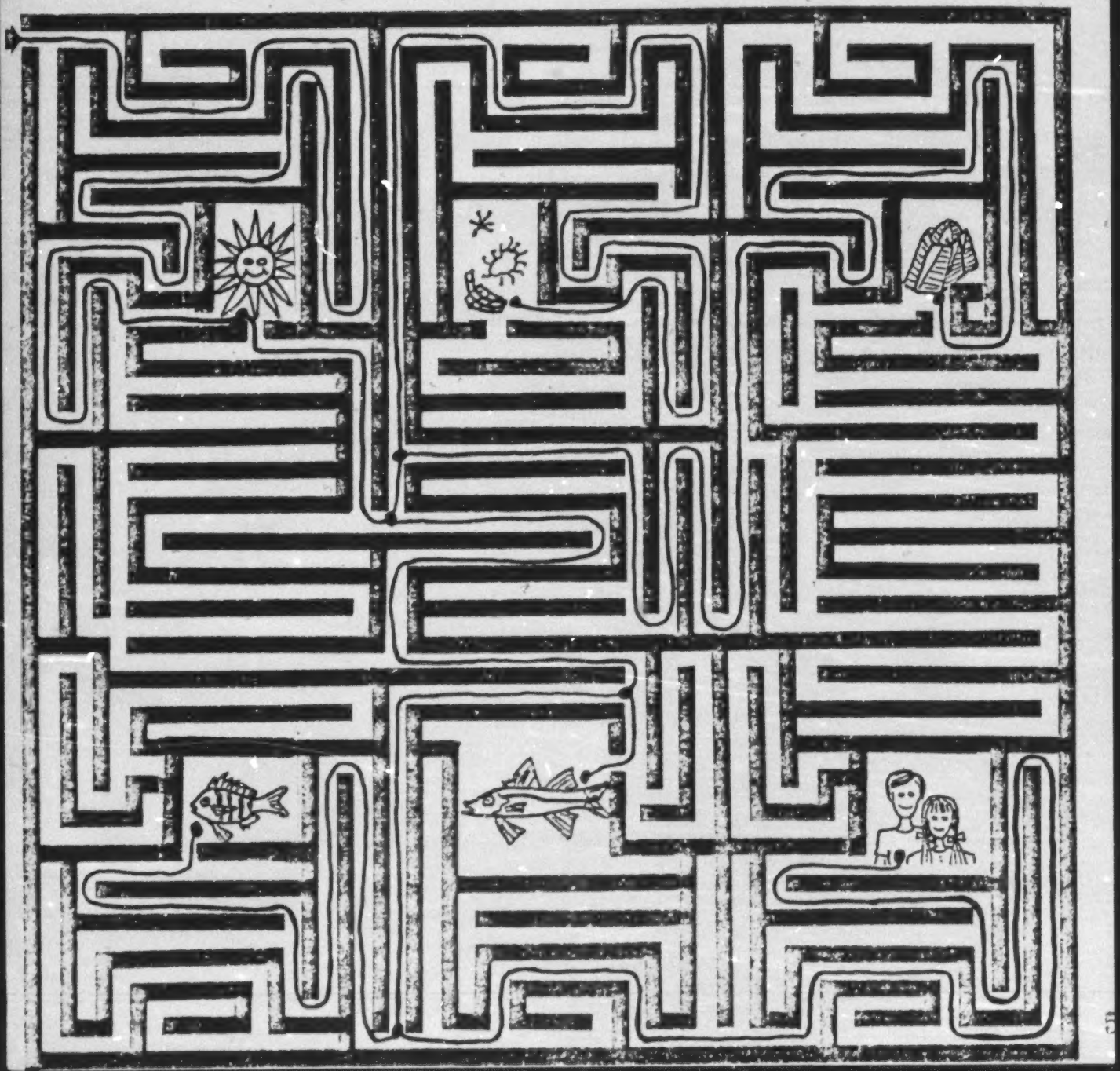
THE BUTTERFLY MAZE

Use the pattern of this beautiful butterfly for a maze or for coloring.
Better yet, why not do both!



Here is another maze - it is called the "Food Web Maze". Since it is a long and difficult journey for the sun's energy to get to humans, this maze is also a bit difficult.

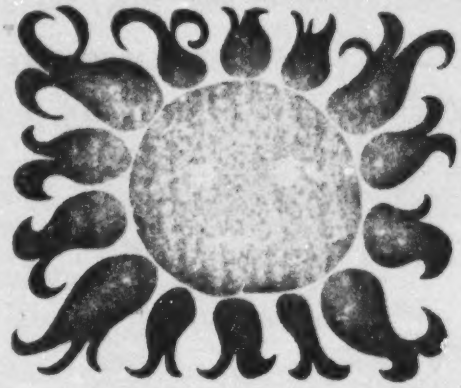
Begin with the Sun and go to Plankton, then Barnacle, on to the Sheepshead, to the Snook and at last to Man. You may retrace any of your moves.



TEAM _____ 5th Grade
SCHOOL _____

MANGROVE DATA SHEET

AN ECOSYSTEM IS THE WORKING TOGETHER OF THE LIVING THINGS WITH THE NON-LIVING THINGS. THESE NON-LIVING THINGS ARE CALLED PHYSICAL FACTORS. LET'S RECORD SOME OF THE PHYSICAL FACTORS AS THEY ARE TODAY.



1. TODAY'S DATE:

   _____

2. THE WEATHER TODAY IS:

   _____

3. WHAT IS THE TEMPERATURE OF THE AIR?

   _____ ^{o}F _____ ^{o}C

4. NOW USING THE HYDROMETER KIT, TAKE A SAMPLE OF WATER FROM AROUND THE MANGROVES.

← WHAT IS THE HYDROMETER READING?

_____

← WHAT IS THE TEMPERATURE OF THE WATER?

_____

NOW USING THE SALINITY CHART - FIND THE SALINITY OF THE WATER.

_____

5. WHICH IS WARMER THE AIR OR THE WATER? _____

   HOW MUCH WARMER? _____

6. USING THE HAND ANEMOMETER (WIND GAUGE) FIND HOW FAST THE WIND IS BLOWING. _____ →

   THE WIND SPEED IS _____ M.P.H?

7. FIND SOMETHING THAT WILL FLOAT AND PUT IT IN THE WATER AROUND THE MANGROVES

   IS THERE MUCH OF A CURRENT? _____

8. TURBIDITY MEANS HOW CLOUDY THE WATER IS. PUT YOUR FOOT ABOUT 30 CM UNDER

   THE WATER. HOW WELL CAN YOU SEE YOUR FOOT? _____

   WOULD YOU SAY THAT THE WATER IS VERY TURBID? _____

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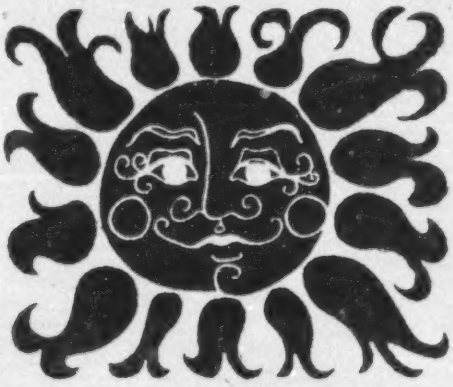
TEAM _____ 5th Grade
SCHOOL _____

GRASSFLAT DATA SHEET



1. TODAY'S DATE

   _____

2. THE WEATHER TODAY IS:

   _____

3. WHAT IS THE TEMPERATURE OF THE AIR?

   _____ ^{o}F _____ ^{o}C

4. NOW USING THE HYDROMETER KIT, TAKE A SAMPLE OF WATER FROM AROUND THE GRASSFLATS.

   ← WHAT IS THE HYDROMETER READING?

   _____

   ← WHAT IS THE TEMPERATURE OF THE WATER?

   _____

   NOW USING THE SALINITY CHART - FIND THE SALINITY OF THE WATER.

   _____

5. WHICH IS WARMER THE AIR OR THE WATER? _____

   HOW MUCH WARMER? _____

6. USING THE HAND ANEMOMETER (WIND GAUGE) FIND HOW FAST THE WIND IS BLOWING? _____ →

   THE WIND SPEED IS _____ M.P.H.

7. FIND SOMETHING THAT WILL FLOAT AND PUT IT IN THE WATER AROUND THE GRASSFLATS.

   IS THERE MUCH OF A CURRENT? _____

   WHAT IS THE CONDITION OF THE WATER? (ROUGH, CHOPPY, SMOOTH) _____

8. TURBIDITY MEANS HOW CLOUDY THE WATER IS. PUT YOUR FOOT ABOUT 30 CM UNDER THE WATER. HOW WELL CAN YOU SEE YOUR FOOT? _____

   WOULD YOU SAY THAT THE WATER IS VERY TURBID? _____

- - - - -

BEFORE YOUR GROUP BEGINS TO SEINE FIND THE FOLLOWING INFORMATION.

9. HOW DEEP IS THE WATER IN THE GRASSFLAT AREA? _____ (centimeters)

10. HOW FAR FROM SHORE IS THE GRASSFLAT? _____ (meters)

11. What type bottom does the grassflat have? _____

12. What kind of grass is growing in the grassflats? _____

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ORGANISM CHECK LIST

GROUP _____ DATE _____

ORGANISM	MANGROVES	GRASSFLATS
sponges		
jellyfish		
comb jellyfish		
MOLLUSKS		
clam		
oyster		
mussels		
snail		
nudibranch		
ARTHROPODS		
shrimp		
fiddler crab		
blue crab		
hermit crab		
spider crab		
horseshoe crab		
mangrove crab		

ORGANISM	MANGROVES	GRASSFLATS
CHORDATES		
sea squirt		
Fish		
stingray		
butterfly ray		
big eye mojarra		
file		
flounder		
mangrove snapper		
pinfish		
pipefish		
pompano		
puffer		
sargassum		
mullet		
sea horse		
sheepshead		
silversides		
spiny box		
toadfish		
snook		
Birds		
blue heron		
gull		

ORGANISM	MANGROVES	GRASSFLATS
Birds (cont'd)		
egret		
pelican		
OTHER ANIMALS		
PLANTS		
red algae		
brown algae		
green algae		
turtle grass		
manatee grass		
red mangrove		
black mangrove		
white mangrove		

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5TH GRADE - OVERALL TEST

WHAT IS AN ECOSYSTEM

1. In an ecosystem, energy is:

   a. destroyed
   b. created
   c. exchanged
   d. detritus

2. Which of the following can make and store its own food?

   a. snook
   b. sea squirt
   c. grasshopper
   d. manatee grass

3. How does one organism get its energy from another organism?

   a. through photosynthesis
   b. by temperature change
   c. by eating it
   d. through turbidity

4. Where does all energy come from first?

   a. sea
   b. sun
   c. wind
   d. grassflats

5. What changes the sun's energy into energy for other living organisms?

   a. sea
   b. animals
   c. plants
   d. currents

6. What are some very important producers of the Indian River Ecosystem?

   a. zooplankton
   b. fish
   c. oysters
   d. shoal grass

7. A crab larva is a member of which of the following?

   a. zooplankton
   b. phytoplankton
   c. hydrometers
   d. physical factors

8. Many animals are found eating around the mangrove roots. What are they eating?

   a. prop roots
   b. breathing roots
   c. physical factors
   d. detritus

What Is An Ecosystem (cont'd)

9. The working together of the living things with the non-living things around them is called:

   a. a population
   c. a community
   c. an ecosystem
   d. a rookery

10. In an ecosystem such things as wind, current, temperature and salinity are called:

   a. rookeries
   c. populations
   b. communities
   d. the physical factors

FOOD WEBS

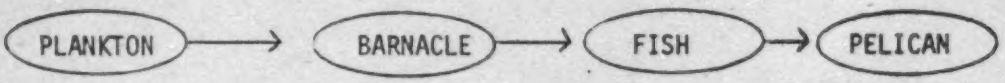
11. The arrow (⟶) in a food chain or food web means:

    a. is talked to
    b. is taken from
    c. is decaying
    d. is eaten by

12. In a food web, an organism can eat:

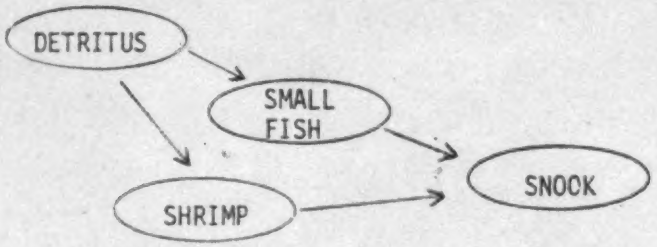
    a. only one other organism
    b. only two other organisms
    c. many organisms
    d. only spiders

13. Using the following food chain choose the statement which is true:



    a. the fish is eaten by the barnacle
    b. the plankton is eaten by the fish
    c. the barnacle is eaten by the fish
    d. the pelican is eaten by the fish

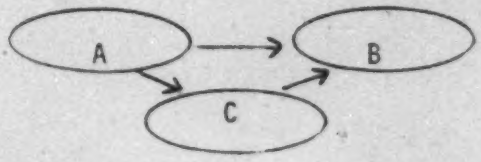
14. Using the following food web choose the statement which is true:



    a. detritus is eaten by the small fish and snook
    b. detritus is eaten by the snook
    c. the shrimp eats the small fish
    d. the snook eats the small fish and shrimp

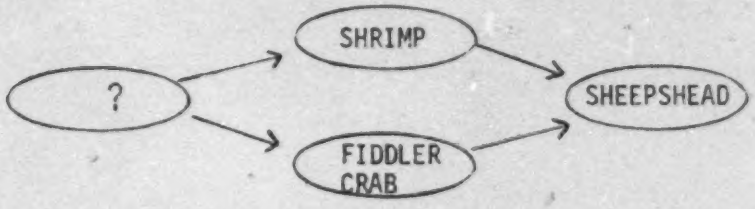
Food Webs (cont'd)

15. Using the following food web, select the correct statement:



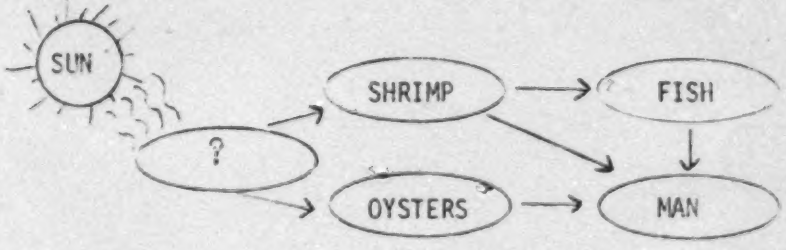
a. B is eaten by A
b. C is eaten by A
c. A is eaten by B
d. B is eaten by C

16. Choose the name of the organism that will complete the food web correctly:



a. frog
b. detritus
c. pelican
d. barnacle

17. Choose the name of the organism that will complete the food web correctly:



a. zooplankton
b. phytoplankton
c. shoal grass
d. red mangroves

18. The arrows between organisms (⟶) in a food web shows the flow of what?

a. detritus
b. plankton
c. larva
d. energy

19. On the answer sheet - fill in the blank circles to construct a food web from the following:

ALGAE

SHRIMP

MULLET

SNOOK

20. On the answer sheet - fill in the blank circles to construct a food web from the following:

ALGAE

SHRIMP

MULLET

SNOOK

MAN

VOCABULARY

21. An early stage of life for some organisms in which they do not resemble their parents is called:

a. larva
b. phytoplankton
c. detritus
d. web

22. The swift movement of a body of water is called:

a. lagoon
b. eddy
c. consumer
d. current

23. A body of water that is separated from the sea by a sand bar, island or reef is called:

a. ocean
b. lagoon
c. spring
d. well

24. Turbidity means:

a. how cloudy
b. how salty
c. how warm
d. how old

25. An animal which eats other animals is called a:

a. consumer
b. producer
c. herbivore
d. phytoplankton

26. A floating instrument used to measure the amount of salt in water is called:

a. speedometer
b. addometer
c. hydrometer
d. thermometer

27. The working together of the living things with the non-living things around them is called:

a. a lagoon
b. an ecosystem
c. the salinity
d. the turbidity

28. What is it called when plants and animals live and work together?

a. population
b. community
c. shoreline
d. mollusk

29. An organism that can produce and store its own food is called a:

a. carnivore
b. herbivore
c. consumer
d. producer

30. An animal which eats only plants is called a:

a. carnivore
b. herbivore
c. phytoplankton
d. producer

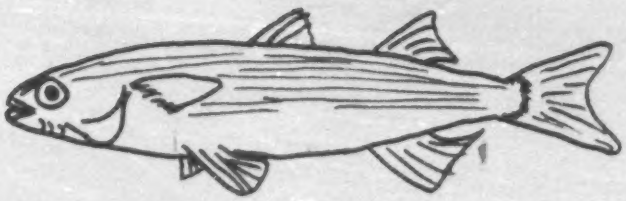
ORGANISMS

Each question has a drawing of an organism and four choices for the name of that organism.

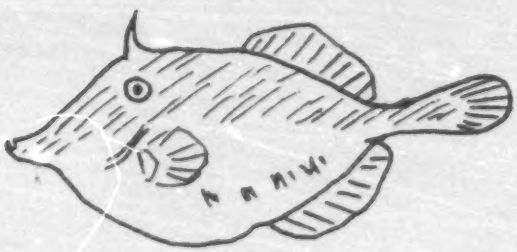
Select the correct name for each organism and record the letter for that name on your answer sheet.

31.

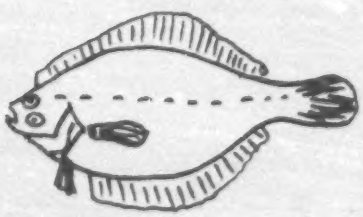
a. mullet
b. filefish
c. snook
d. sheepshead

32. 

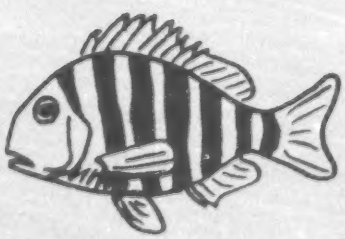
a. mullet
b. filefish
c. snook
d. sheepshead

33. 

a. mullet
b. sheepshead
c. flounder
d. filefish

34. 

a. mullet
b. sheepshead
c. flounder
d. filefish

35. 

a. mullet
b. sheepshead
c. flounder
d. filefish

36. The tiny, floating <u>animals</u> that are found in the sea are called:

a. zooplankton
b. phytoplankton
c. algae
d. rookery

37. The tiny floating plants of the sea are known as:

a. manatee grass
b. phytoplankton
c. zooplankton
d. larva

38. Which of the following would a sea squirt eat?

a. flounder
b. plankton
c. mollusks
d. barnacles

39. Which of the following fish eats mainly algae?

a. snook
b. sheepshead
c. mullet
d. flounder

40. Which of the following fish eat such animals as barnacles and crabs?

a. snook
b. sheepshead
c. mullet
d. needlefish

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ANSWER SHEET

#_____

5th Grade OVERALL Test

Name_____ School_____ Teacher_____

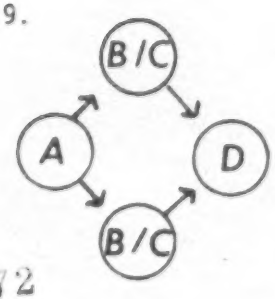
(Ecosystem)

1. A B (C) D
2. A B C (D)
3. A B (C) D
4. A (B) C D
5. A B (C) D
6. A B C (D)
7. (A) B C D
8. A B C (D)
9. A (B) C D
10. A B C (D)

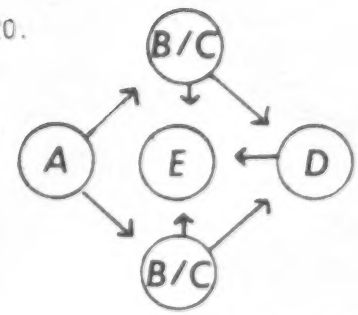
(Food Web)

11. A B C (D)
12. A B (C) D
13. A B (C) D
14. A B C (D)
15. A B (C) D
16. A (B) C D
17. A (B) C D
18. A B C (D)

19.



20.



Pre/Post #_____

ANSWER SHEET

5th Grade OVERALL Test

Name_____ School_____ Teacher_____

(Vocabulary)

21.	(A)	B	C	D	31.	A	B	(C)	D
22.	A	B	C	(D)	32.	(A)	B	C	D
23.	A	(B)	C	D	33.	A	B	C	(D)
24.	(A)	B	C	D	34.	A	B	(C)	D
25.	(A)	B	C	D	35.	A	(E)	C	D
26.	A	B	(C)	D	36.	(A)	B	C	D
27.	A	(B)	C	D	37.	A	(B)	C	D
28.	A	(B)	C	D	38.	A	(E)	C	D
29.	A	B	C	(D)	39.	A	B	(E)	D
30.	A	(B)	C	D	40.	A	(B)	C	D